ELECTROCRAFT ILLUSTRATED LIST

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ATHENÆUM
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ELECTROCRAFT ILLUSTRATED LIST

of

Officially Approved Electrical Supplies

to which is added

AN ILLUSTRATED LIST OF OTHER REPRESENTATIVE LINES OF ELECTRICAL MATERIAL

(See Section 2, Pages 131-149)

and

Revised National Electrical Code

Illustrated and Explained.

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Published in the interest of the buyers
of electrical supplies

A COPY of this book is in the possession of every manufacturer whose goods are listed herein. Persons communicating, therefore, with the manufacturers about any listed article will find it greatly to their and the manufacturer's advantage to refer to this list.

Electrocraft's Information Bureau

for users of this book, and
for the trade generally

INQUIRIES are invited for any additional information that may be needed concerning the material described in this book.

Questions of any nature relating to the application, capacity, etc., of devices listed herein will be promptly furnished upon request and without charge.

Inquiries regarding electrical material not listed in this book will also be answered without charge and as fully as possible.

Address all inquiries to

ELECTROCRAFT PUBLISHING CO., DETROIT, MICH.

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To the Electrical Construction Trade

THE history of the ELECTROCRAFT ILLUSTRATED LIST has been one of continuous progress and development. It was first issued in October, 1906, as a small paper covered book, the edition numbering but 2,000 copies. A second edition of 2000 was immediately called for. The next edition—that of 1907—numbered 6000 copies, and was promptly and eagerly absorbed by the trade. This edition showed a great improvement over the former one; it included an illustrated reprint of the National Electrical Code, a feature of vast interest to the electrical construction trade.

The 1909 edition numbering 10,000 copies, and greatly increased in size, takes another long step forward. The persistent demand of the trade for fuller information on the principal lines listed, the increasing number of new approvals issuing from the Underwriters' Laboratories, together with the vastly heightened importance which National Code standards of construction have assumed in the eyes of construction men, all combined to make it both necessary and desirable to build the List on larger and fuller lines.

In presenting, therefore, the 1909 edition of the ELECTROCRAFT ILLUSTRATED LIST to the trade, we feel that we have fully met the need of the buyers of electrical supplies for a reference book which not only furnishes a complete list of the material required by the Underwriters to be used in construction, drawn from official sources, but which sets forth that very necessary information in a manner that secures for the trade the widest possible view of the officially approved lines and the greatest facilities for selecting safe material.

Attention is called to Section 2 (Pages 131-149) of this volume in which Miscellaneous Electrical Material is shown. This is a new feature of the ELECTROCRAFT ILLUSTRATED LIST and one that will greatly increase its value to the construction trade. It represents our first step in the carrying out of our plan for making the ELECTROCRAFT ILLUSTRATED LIST as complete and reliable in all classes of electrical material as it now is in officially approved supplies, and thus enable the users of the LIST to find within its covers adequate and reliable information on practically everything electrical that they have occasion to purchase.

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ATTACHMENT PLUGS.

"Benjamin" Attachment Plug, Cat. No. 903. 3 A., 250 V. Rotating sleeve makes it possible to attach plug without turning device. Twisting of the cord is therefore unnecessary.

Cord is firmly secured and held by cap grip. There are no detachable parts to become lost or broken.

This plug is small and neat, both in construction and appearance.

List Price $0.25.
Approved Jan. 27, 1908.

BENJAMIN ELECTRIC MFG. CO.,
42 West Jackson Blvd., Chicago, Ill.

Cat. No. 16410 Cat. No. 6508

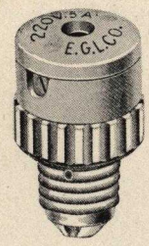
"Mesco," Edison type, 3 A, 250 V. Two-piece, separable cap, Cat. No. 16410 and porcelain cap, Cat. No. 6508. Approved June 18, '06.

MANHATTAN ELECTRICAL SUPPLY COMPANY.,
New York.

Cat. Nos. 1948 and 1949
3 A, 250 V.

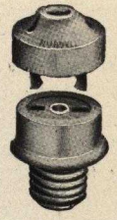
Approved April 23, '06.

BRYANT ELECTRIC CO.,
Bridgeport, Conn.



Howe's Swivelling Plug.
Approved Feb. 14, 1906.

ELEC. GOODS MFG. CO.,
Boston, Mass.



Cat. No. 5406.

Approved Dec. 12, 1904.
Also Cat. Nos. 5520 and 5522. Approved Feb. 17, 1908.

HARVEY HUBBELL,
Bridgeport, Conn.

Cat. No. 34153 Cat. No. 42456

Approved Mch. 23, '05.
Also Cat. Nos. 28840 and 50996.
Approved Sept. 26, '06.

GENERAL ELECTRIC CO.,
Schenectady, N. Y.

Cat. No. 430.

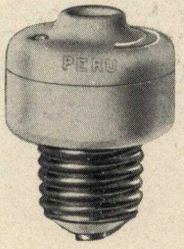
Approved Sept. 11, '05.

H. T. PAISTE CO.,
Philalelphia, Pa.

Cat. No. 67. Cat. No. 147.

Approved June 12, '06. Approved Dec. 12, '04.
Also Cat. No. 3100, P. & S. Swivel.

PASS & SEYMOUR, Inc.,
Solvay, N. Y.



Cat. No. 31286.

Approved June 3, '05.

PERU ELECTRIC MFG. CO.,
Peru, Ind.

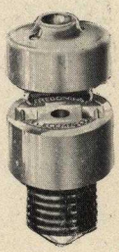
Cat. No. 3284. Approved Mch. 20, 1908.

Cat. No. 3286. Approved Dec. 12, 1904.

Also Cat. Nos. 3530 and 3287.

Cat. No. 3386. With glass tube enclosed fuses. Also Cat. No. 3387. Approved April 24, 1907.

PERKINS ELECTRIC SWITCH MFG. CO., Bridgeport, Conn.

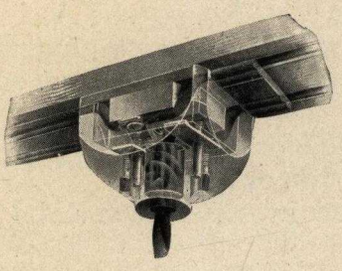


Cat. No. 222.

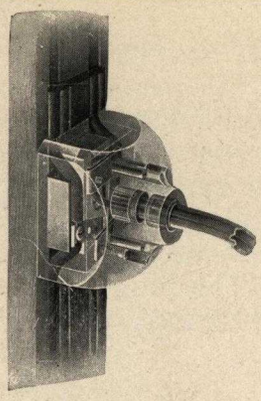
Approved Aug. 14, '07.

TREGONING ELEC. MFG. CO.,
Cleveland, Ohio.

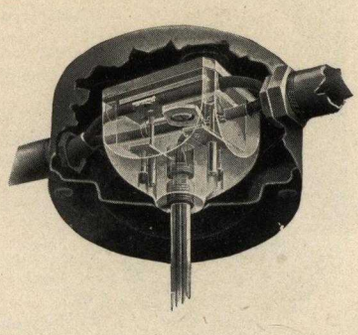
ROSETTES,—FUSELESS.



Type A-33½
"Norbitt" Cord Rosette for Moulding.



Type A-33⅛
"Norbitt" Moulding Fixture Rosette.



Type C-33⅛
"Norbitt" Conduit Fixture Rosette.

"Norbitt" Conduit and Moulding types. Approved Nov. 28, '04.

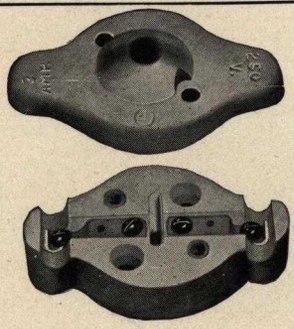
CROUSE-HINDS CO., Syracuse, N. Y.

"Freeman" two-piece fuseless rosette, 3-A, 250 V.

This Rosette was designed to meet the requirements of the Underwriters and persons demanding a first-class rosette.

Packed 10 in a box, 250 in a case.

List Price, $0.20.



Cat. No. 310.
Approved April 13, '08.

In some of the older styles of rosettes, it is not always possible to make a sightly job on account of the difference in elevation between the knobs and the rosettes. This rosette is designed especially for open wiring and makes an effective installation. Distance between wires, 2½ inches.

E. H. FREEMAN ELECTRIC CO., Trenton, N. J.

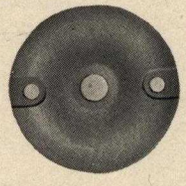
Cat. No. 16417.

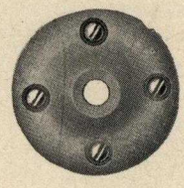
Cat. No. 16419.

"Mesco," 3 A. 250 V. Cat. No. 16417, cleat with connections on cap, with sub-base; Cat. No. 16418 cleat, connections on base; Cat. No. 16419, moulding, connections on base; Cat. No. 16420, concealed, connections on base. Std. pkg. 250.

Approved July 5, '07.

MANHATTAN ELECTRIC SUPPLY CO.,
New York, N. Y.





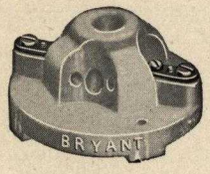
"National." For use with National metal moulding. No. 348, one piece; No. 349, two piece.

No. 348 requires wires to be soldered at connections; List Price, $0.10.

No. 349 does not require soldering; has clamp connections; List Price $0.25.

Approved Sept. 10, '07.

NATIONAL METAL MOLDING CO.,
Pittsburg, Pa.



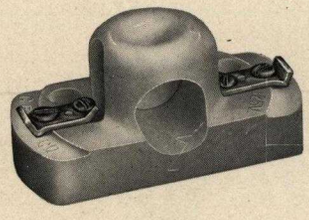
Cat. No. 1499.

Cat. No. 1999.

"K. P." Cleat. Concealed and moulding types, Cat. Nos. 1499, 1710 and 1497. "Junior" cleat types, Nos. 1999 and 297, concealed type, No. 298, and moulding type No. 299. Approved June 8, '07.

Also cleat type No. 869. Approved with porcelain sub-base Approved Dec. 12, '04.

BRYANT ELECTRIC CO., Bridgeport, Conn.



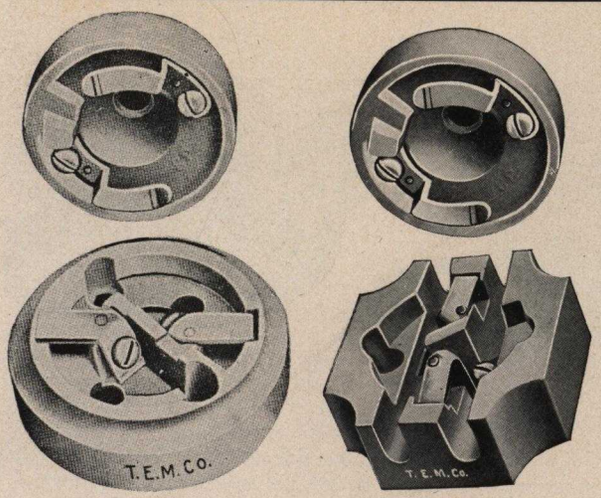
Cat. No. 43111.
One piece ceiling.

Cat. No. 39239.
Moulding type.

Single piece, porcelain base, No. 43311. Approved Aug. 2, '07. Cleat, concealed and moulding types, Cat. Nos. 39235, 39237 and 39239 respectively. 3 A. 250 V. Approved Oct. 22, '06. Cleat type, No. 21497; Approved Sept. 26, '05.

GENERAL ELECTRIC CO., Schenectady, N. Y.

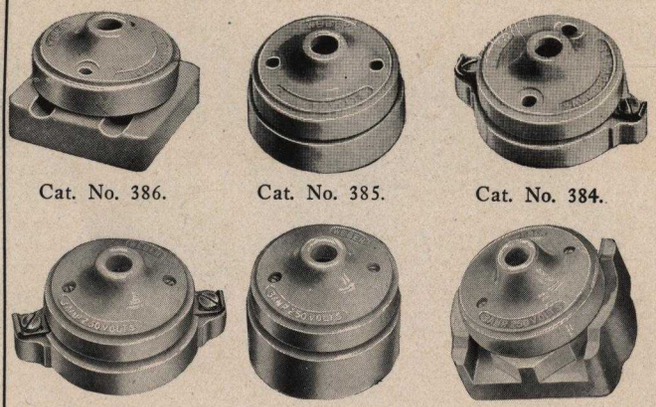
ROSETTES,—FUSELESS—(Continued).



Cat. No. 992. Cat. No. 994.

"Trumbull," cleat type, Cat. No. 992; concealed type, Cat. No. 993; moulding type, Cat. No. 994. Std. pkg. 250.
Approved Jan. 29, '06.

TRUMBULL ELECTRIC MFG. CO., Plainville, Conn.



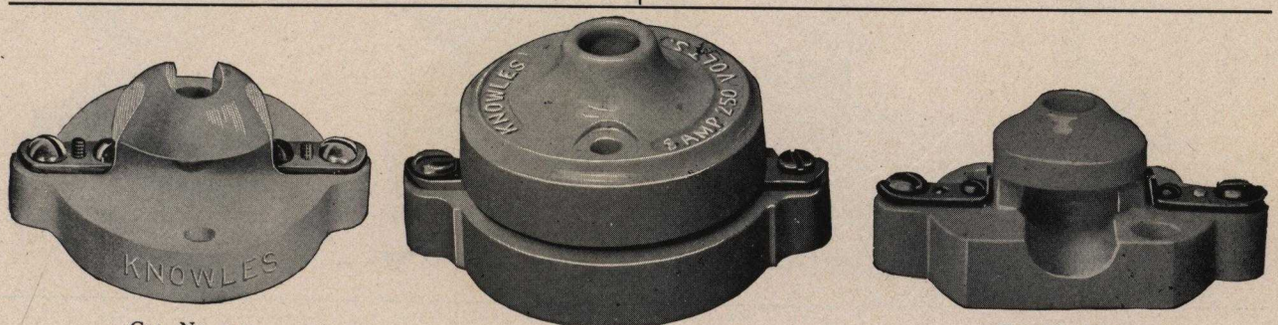
Cat. No. 386. Cat. No. 385. Cat. No. 384.

Cat. No. 315 A. Cat. No. 378 A. Cat. No. 351A.

"Weber," cleat types, Cat. Nos. 315 A. and 384; concealed types, 378 A. and 385; moulding types, Cat. Nos. 351 A. and 386. Std. pkg. 250.

Approved June 18, '06.

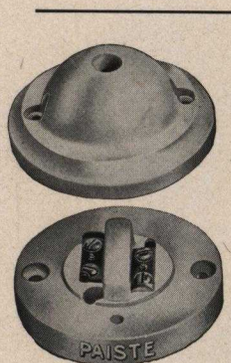
HENRY D. SEARS, General Sales Agent, 131 State St., Boston, Mass.



Cat. No. 2550. Cat. No. 2500. Cat. No. 2696.

"Knowles" Cleat types, Cat. Nos. 2500, 2550, 2696 and 1601, 3 A. 250 V.
Approved Nov. 19, '07.

C. S. KNOWLES, 7 Arch St., Boston, Mass.



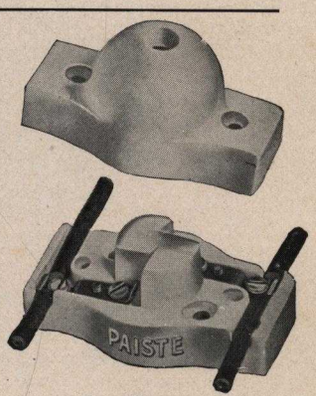
Cat. No. 441.

"Fielding" Cleat, Concealed and Moulding Types.

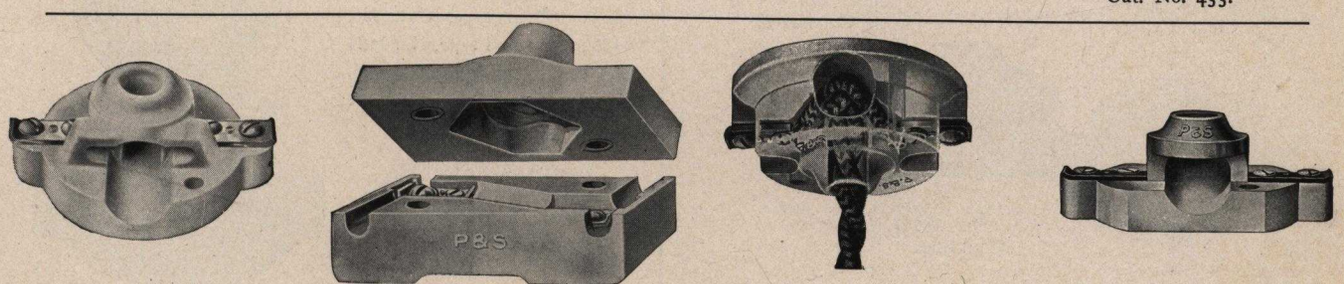
Cat. No. 433, for cleat or open wiring, plain style for drop cord, std. pkg. 250; Cat. No. 435, two-wire moulding, for drop cord, std. pkg. 250; Cat. No. 436, two-wire moulding, bracket style for fixture work, std. pkg. 100; Cat. No. 437, three-wire moulding, plain style for drop cord, std. pkg. 250; Cat. No. 438, three-wire moulding, bracket style for fixture work, std pkg. 100; Cat. No. 441, concealed type for drop cord, std. pkg. 250; Cat. No. 480, cleat type, two piece, std. pkg. 250..

Approved Feb. 13, '07.

H. T. PAISTE CO., Philadelphia, Pa.



Cat. No. 433.

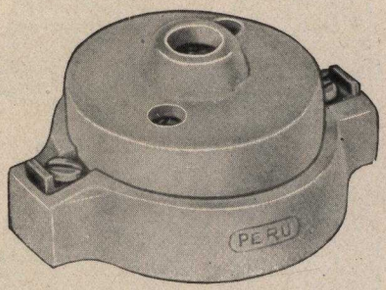


Cat. No. 603. Cat. No. 607. Cat. No. 602. Cat. No. 703.

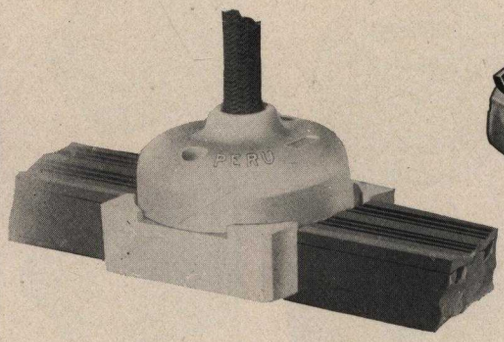
"P. & S." 3 A. 250 V. Cleat types, Cat. Nos. 602, 603, 607, 703 and 06, with porcelain sub-bases. Concealed type, No. 604. Moulding type, No. 608. Ceiling buttons, Nos. 70 and 170. Approved Jan 3, 1908.
Also cleat type, No. 609. Approved Oct. 22, '07.

PASS & SEYMOUR, INC., Solvay, N. Y.

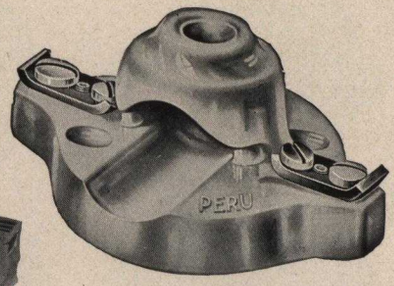
ROSETTES,—FUSELESS—(Continued) and ROSETTES,—ENCLOSED FUSE



Cat. No. 986.



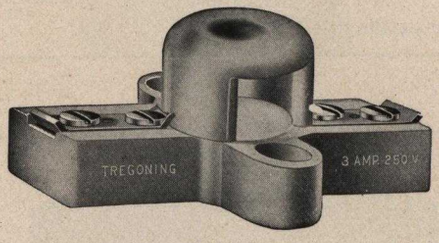
Peru Tie Button



Cat. No. 990.

"Peru," Cleat types, Cat. Nos. 985, 986, 7422, 990 and 7421 with porcelain sub-base; concealed type Cat. No. 987. Porcelain tie buttons, concealed and moulding types. Porcelain tie button and cleat, improved type, 3 A. 250 V. Approved June 7, 1907.

PERU ELECTRIC MFG. CO., Peru, Ind.



"Tregoning," 3 A. 250 V. Cat. No. 233. Approved Aug. 14, '07.

TREGONING ELECTRIC MFG. CO., Cleveland, Ohio.

"Mebane," cleat type, No. 74-71. Approved Mch. 13, 1907.
(Cuts not available.)

J. A. MEBANE COMPANY, South Boston, Mass.

ROSETTES,—ENCLOSED FUSE.

Cat. No. 32578,
Cleat Type.

Cat. No. 40496,
Concealed.

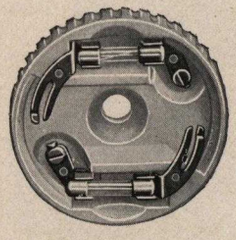
Cat. No. 40497,
Moulding.

"G. E." 2 A. 250 V. for use with glass tube enclosed fuses. Std. pkg. 250. Approved July 31, '06.

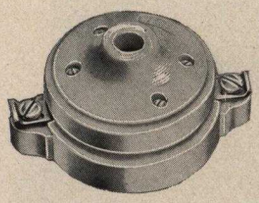
GENERAL ELECTRIC CO.,
Schenectady, N. Y.

"Thomas" 2 A. 250 V. for use with glass tube enclosed fuses. Cleat type, Cat. No. 3423; concealed type, No. 3424 and Moulding type, No. 3425. Std. pkg. 250. Approved June 8, '07.

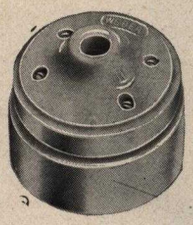
PERKINS ELECTRIC SWITCH MFG. CO., Bridgeport, Conn.



ROSETTES,—LINK FUSE.



Cat. No. 315, Cleat.

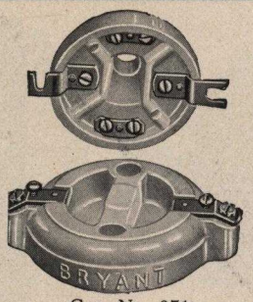


Cat. No. 378, Concealed.

The covers of these Rosettes are of the same design and are interchangeable. The metal contacts are heavy and the interior arrangement of metal parts and fuse cavities prevent short circuiting. The covers are easily placed in position by a quarter turn and are securely held in place.

Std. pkg. 250. Approved May 13, '05.

HENRY D. SEARS, General Sales Agent.,
131 State St., Boston, Mass.



Cat. No. 871.

No. 873.

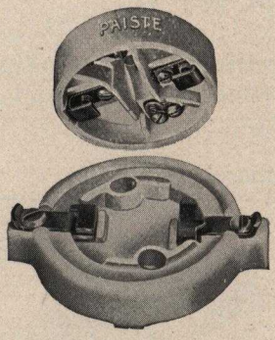
K. W. Rosettes, Cat. Nos. 950, 870 and 871. Approved Dec. 12, '04.

K. W. bracket rosettes, cleat and concealed types. Cat. No. 873, 1073, 1176, 1178. Approved Aug. 14, '06.

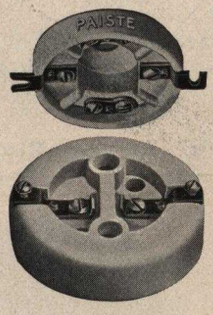
Also "Bryant Junior," cleat No. 1501, and concealed No. 1502. Also combined cleat and fusible rosette No. 965.

Approved April 26, '07.

BRYANT ELECTRIC CO., Bridgeport, Conn.



Cat. No. 816.

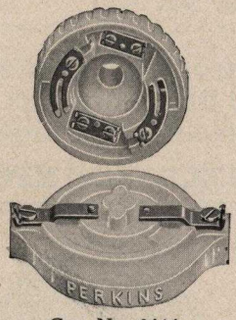


Cat. No. 871, Concealed.

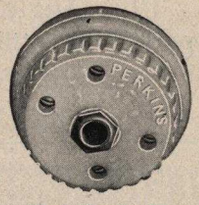
2 A. 125 V. "P. K" types, Nos 816, 810, 811, cleat and concealed types. "K. W." Nos. 870, 871, 950, 951, 1176 and 873.

Approved June 8, '08.

H. T. PAISTE CO., Philadelphia, Pa.



Cat. No. 3414.



Cat. No. 3418.

"Thomas" cleat and concealed types. Cat. Nos. 3414 and 3415. Bracket styles, cleat and concealed types, Cat. Nos. 3417 and 3418..

Approved May 20, '07.

PERKINS ELECTRIC SWITCH MFG. CO.,
Bridgeport, Conn.

Cat. No. 39234.

Cat. No. 60124.

Cleat and concealed types. Cat. Nos. 39234 and 39236, 2 A. 125. Approved Sept. 2, '08. Also cleat and concealed types, Nos. 60123 and 60124. (Slightly larger than 39234 and 39236.) Approved June 30, '05.

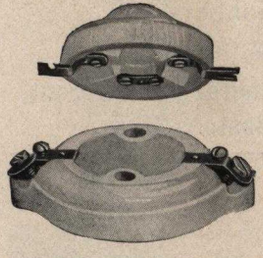
GENERAL ELECTRIC CO., Schenectady, N. Y.

Cat. No. 230.

"Tregoning" two piece porcelain rosettes, 2 A. 125 V. cleat type, Cat. No. 230; concealed type, Cat. No. 232.

Approved Aug. 14, '07.

TREGONING ELECTRIC MFG. CO.,
Cleveland, Ohio.



"M. S." cleat type, with stamped lugs.

Cat. No. 950.

Approved April 9, '07.

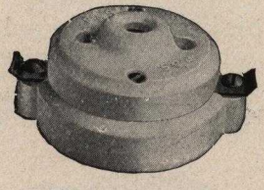
MARSHALL ELEC. MFG. CO.,
Boston, Mass.

"P. & S." cleat type.

Cat. No. 400. 125 V.

Approved Dec. 20, '04.

PASS & SEYMOUR, INC.,
Solvay, N. Y.



"Mebane," cleat type, Cat. No. "O. K." 74-71, 3 A. 250 V. Approved Mch. 13, '07.
(Cuts not available.)

J. A. MEBANE COMPANY, South Boston, Mass.

SOCKETS,—STANDARD.

Cat. No. 411.
Approved Sept. 10, 1907.

Cat. No. 412.
Approved Sept. 13, 1906.

Cat. No. 492
Approved Sept. 13, '06.

Cat. No.	Style	List Price	Std. Pkg.
411	Angle Socket, Polished Brass, ⅛"	$0.35	50
451	Angle Socket, Polished Brass, ¼"	.35	50
431	Angle Socket, Polished Brass, ⅜"	.40	50
491	Angle Socket, Polished Brass, with Wall Flange	.45	50

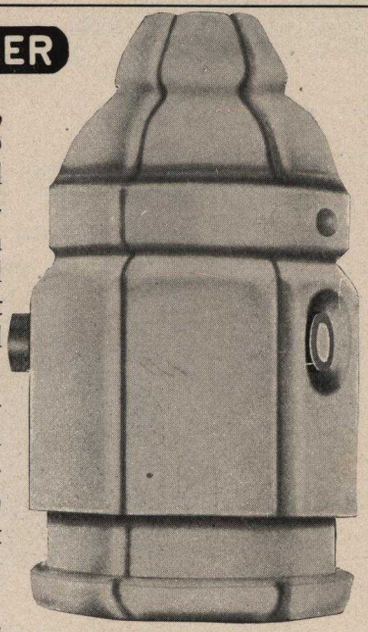
Cat. No.	Style	List Price	Std. Pkg.
412	Twin Socket, Polished Brass, ⅛"	$0.65	50
452	Twin Socket, Polished Brass, ¼"	.65	50
432	Twin Socket, Polished Brass, ⅜"	.70	50
492	Twin Socket, Polished Brass, with Wall Flange	.75	50

Plug Angle Sockets and Plug Twin Sockets are provided with rotating sleeve, making it possible to attach and fix the device in any desired position without rotation. For nickel plating add four cents list for Angle Sockets; five cents list for Twin Sockets.

BENJAMIN ELECTRIC MFG. CO., 42 W. Jackson Blvd., Chicago, Ill.

CUTLER-HAMMER

This porcelain, pendant, lamp socket is equipped with the same simple, push button mechanism used in the pendant switches described on page 36. It is symmetrical in appearance and lights and extinguishes the lamp without tilting it out of its normal vertical position, or jarring it in any way. This means that it is a mighty good socket to install with Tungsten or other lamps having a delicate, fragile filament.



Actual Size
Cat. No. 7400
6 A. 125 V. 2 A. 250 V.

It is designed for use with any type of Edison base lamp. Made of porcelain in plain white and colored glazes.

THE CUTLER-HAMMER MFG. CO., Milwaukee, Wis. e

"Weber" Brass Shell Sockets.

No. 61372, key, ⅛ inch. No. 61373, key, ⅜ inch. No. 61374, keyless, ⅛ inch. No. 61375, keyless, ⅜ inch.

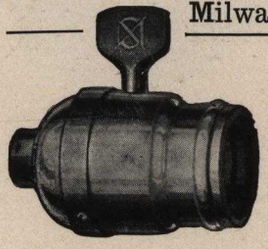
Also Pendant types, Cat. Nos. 61773 and 61775.

Neither screws nor rivets are used in these sockets to hold shell and cap together. Shell is locked securely to cap and cannot become loose but can be readily removed or replaced without screw driver or tool.

The design of these sockets is such as to secure simplicity and rigidity of construction, neatness in design and convenience in wiring. For sale by all jobbers.

Approved Aug. 20, '08.

HENRY D. SEARS, General Sales Agent, 131 State St., Boston, Mass.



M. S. Brass shell, key and keyless. Cat. Nos. 9386, 9392, 50760, 50768. Also above types with shade holders attached.

Approved Oct. 1, '07.

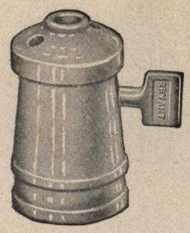
MARSHALL ELEC. MFG. CO., Boston, Mass.

"Yost" key and keyless, brass shell, Edison and T. H. types.

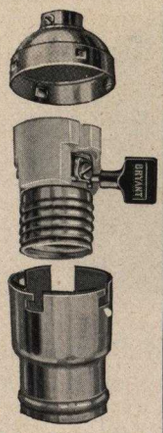
Approved Nov. 25, '04.

YOST ELECTRIC MFG. CO., Toledo, Ohio.

SOCKETS,—STANDARD—(Continued).



Cat. No. 9395



Cat. No. 44147

"Bryant" brass shell, key, 50 c. p. 250 V.; keyless, 3 A. 250 V. Cat. Nos. 9386, 9392, 50760, 50768, 99386, 99392, 43389, 43390.

Fixture sockets, 1317 to 1320 inclusive.

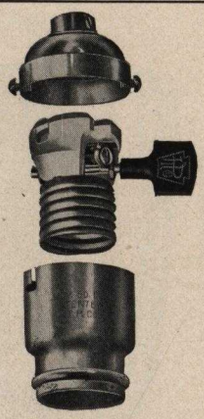
"Security Snap" types Nos. 44147 to 44152 inc. 44814 and 44815.

"New Wrinkle" socket Nos. 59480 to 59487 inc. Twin sockets, Cat. Nos. 46750 to 46752 inclusive for use on fixtures only.

Also above types with shade holders attached. Approved Aug. 18, 1908.

Also Edison and T. H. key and keyless types of porcelain shell sockets. Approved for use only in places where they will not be exposed to hard usage. Approved Aug. 17, 1905.

BRYANT ELECTRIC CO., Bridgeport, Conn.

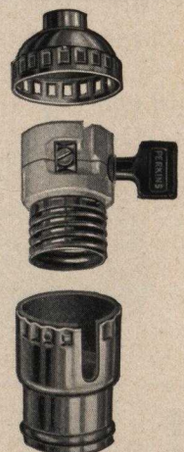


Cat. No. 9386.

Cat. No. 44814.

Brass shell, key and keyless. Cat. Nos. 9386, 9392, 50760, 50768, 19386, 19392, 49386, 49392, 99386, 99392, 43389, 43390; also "Security Snap" types, Cat. Nos. 44147 to 44152 inclusive, 44814 and 44815. Also above types with shade holders attached. Approved Feb. 27, '08.

H. T. PAISTE CO., Philadelphia, Pa.



"Perkins" brass shell, key and keyless, Cat. Nos. 9386P, 9392P, 50760P, 50768P. "New Wrinkle" types, 59480P to 59487P inclusive. Also above types with shade holders attached. Approved May 8, 1908.

PERKINS ELECTRIC SWITCH MFG. CO., Bridgeport, Conn.

Cat. No. 44149.

Cat. No. 9386.

Cat. No. 50896.

"Security Snap," key and keyless, Edison styles. Cat. Nos. 44147 to 44152 incl., 44814 and 44815; also Electroiler keyless, Cat. No. 59596. Also above types with shade holders attached. Approved Sept. 1, '08.

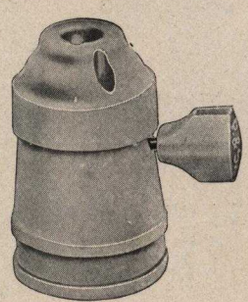
Brass shell types with or without shade holders. Edison types, key, Nos. 9386, 1317, 50760, 44389, 1318, 99386, and Electrolier, Nos. 29623 and 29624; keyless, Nos. 9392, 1319, 50768, 44390, 1320, 99392 and 66237. T. H. types key, Nos. 50713 and 50761; keyless, Nos. 50714 and 50769. Approved Aug. 31, '08.

Brass shell key type lock socket, No. 58951, 50 c. p. 250 V.; key type, No. 58957, 3 A. 250 V. Approved Sept. 10, '08.

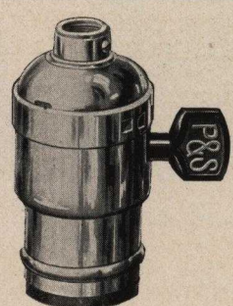
Porcelain shell, Edison types, Nos. 9393, 9395, 50799, 34947, 50896 and 34948. Approved for use only where they will not be exposed to hard usage. Approved Feb. 13, '07.

Porcelain shell socket for temporary decorative work, Cat. No. 37695. Approved Sept. 1, 1908.

GENERAL ELECTRIC CO., Schenectady, N. Y.



Cat. No. 317.

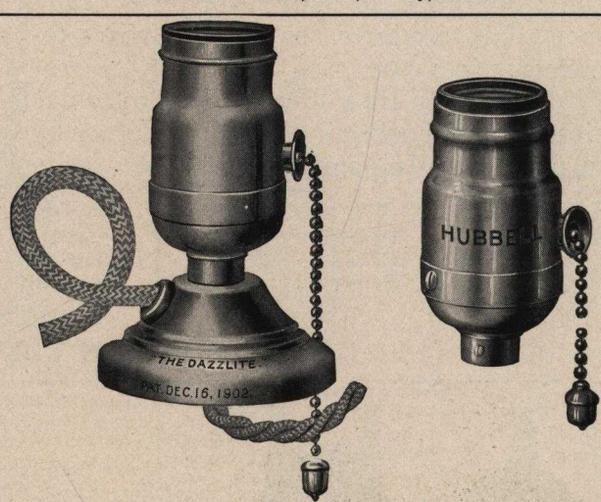


Cat. No. 440.

"P. & S." porcelain, key and keyless, Edison and T. H. types. Approved for use only in places where they will not be exposed to hard usage. Approved Nov. 25, '04.

Also brass shell bey and keyless, Nos. 157, 0157, 357, 0357, 457, 0457, 557, 0557 and 61059 to 61065 incl., with metal keys. Also "Snap Cap" types, Nos. 440-445 incl. Also above types with shade holders attached. Approved July 21, '08.

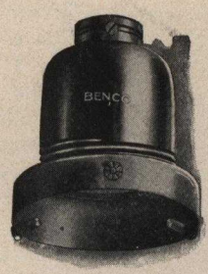
PASS & SEYMOUR, INC., Solvay, N. Y.



"Hubbell" pull sockets, Edison and T. H. types. Approved Mch. 21, '05. Also "Dazzlite" attachment for oil lamps, 50 c. p. 250 V., Cat. Nos. 5403, 5404, 5529 and 5530. Approved Dec. 6, '07.

HARVEY HUBBELL, INC., Bridgeport, Conn.

SOCKETS,—WEATHERPROOF.



Cat. No. 4200

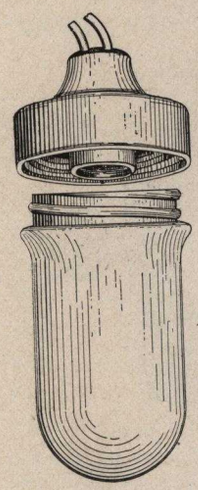
"Benco" Weatherproof Sockets are highly insulated, easily installed and with the various shade holders, are adapted for either indoor or outdoor lighting. Furnished with either 2¼ or 3¼ inch shade holder as desired.

Cat. No.	Style	List Price
4200	With Alum. Shell tapped ½-in.	$0.70
4201	With Alum. Shell tapped ⅜-in.	.70
4201M	With Alum. Shell Male ⅜-in.	.80

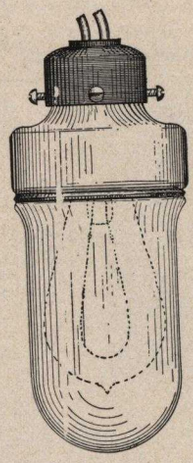
Cat. No.	Style	List Price
4202	With Brass Shell tapped ½-in.	$0.70
4203	With Brass Shell tapped ⅜-in.	.70

Approved Mar. 16, '05. Std. Pkg. 50.

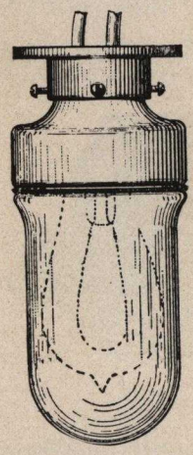
BENJAMIN ELECTRIC MFG. CO., 42 W. Jackson Boulevard, Chicago, Ill.



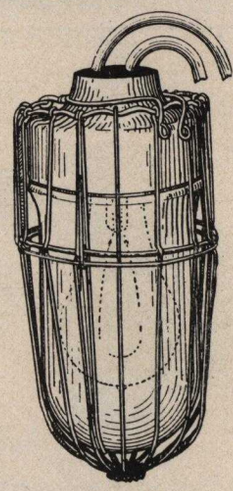
STYLE A



STYLE B



STYLE C



WITH GUARD

Freeman Weatherproof Socket and Vaporproof Globe, 3 A., 250 V. Style A. or Pendant type to hang from wires; style B. or Bracket type, threaded for regular ½ inch pipe or conduit; style C. or flange type for ceiling or side wall. These sockets are furnished with 8 inch wire regularly (any length wires to order). Packed one each in corrugated paper boxes, 12 in a case.

The wires are soldered direct to contacts (flexible wire being used), and contacts are enclosed in the porcelain and held in place by water-proof cement. The porcelain cap cannot turn in the casing and can easily be removed.

Cat. No.	Style	Base	List Price
251	A	Edison	$ 9.00 Doz.
252	B	Edison	12.00 Doz.
253	C	Edison	12.00 Doz.

Cat. No.	Style	Base	List Price
254	A	T. H.	$ 9.00 Doz.
255	B	T. H.	12.00 Doz.
256	C	T. H.	12.00 Doz.

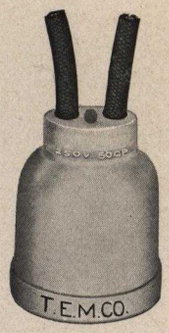
Approved March 2, 1908.

E. H. FREEMAN ELECTRIC CO., Trenton, N. J.

Johns-Pratt moulded composition sockets Edison types. Approved Nov. 30, '06.

H. W. JOHNS-MANVILLE CO., New York, N. Y.

SOCKETS,—WEATHERPROOF—(Continued).



Trumbull porcelain weather-proof socket, Cat. No. 978, 250 V., 50 C. P. Std. pkg. 250

Standard length of wire six inches. Longer wires supplied at extra cost.

Approved Mch. 25, '07.

TRUMBULL ELEC. MFG. CO.,
Plainville, Conn.

"Newcode." Cat. No. 1010. 50 C. P. 250 V. A two-piece porcelain socket for temporary work. Std. pkg. 250. Approved Oct. 29, '06.

Approved for temporary work only.

STANLEY & PATTERSON,
New York, N. Y.

Peru, Pendant Edison Type. Cat. No. 9366. Std. pkg. 250.

Approved Mar. 21, '05.

PERU ELECTRIC MFG. CO.,
Peru, Ind.

Cat. No. 60666.

Cat. No. 9448.

Bryant, 3 A. 250 V. Bracket styles, porcelain shell, Nos. 9496 and 9448; composition shell, Nos. 43311, 43312, 43313 and 43314. Pendant styles, porcelain shell Nos. 9366, 59107, Bragdon 50997; composition shell, Nos. 60666, 43310 and 42686. Approved Sept. 1, '08.

BRYANT ELECTRIC CO.,
Bridgeport, Conn.

Cat. No. 60666.

"Cole" composition sockets, pendant style, Cat. Nos. 60666 and 43310, made in black or brown finish.

Approved June 24, '08.

HENRY COLE & CO.,
Boston, Mass.

Cat. No. 9366.

Cat. No. 60666.

Pendant, Edison type, No. 9366. Approved Nov. 21, '06. Also Edison type moulded composition, 3 A. 250 V. Pendant styles, Nos. 60666 and 43310; bracket styles, Nos. 43311 to 43314 incl. Approved Aug. 29, '08.

Also keyless bracket for 650 V. circuits; aluminum or brass shell, Nos. 32440 to 32443 inclusive. Approved Apr. 16, '07.

GENERAL ELECTRIC CO.,
Schenectady, N. Y.

Cat. No. 22755.

Cat. No. 9448.

"Paiste" weatherproof sockets, 3 A., 250 V. Pendant style, porcelain shell, Cat. Nos. 9366, 38687 and 22754; composition shell, No. 60666. Bracket style, porcelain shell, Nos. 9448, 9496, 45491, 45492, 22755 and 22756.

Approved Mch. 17, .08.

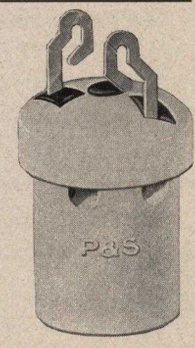
H. T. PAISTE CO.,
Philadelphia, Pa.

"M. S." Cat. No. 9496. Bracket style, porcelain shell, brass cap for ⅜" pipe. 3 A. 250 V.

Approved Dec. 4, '07.

MARSHALL ELEC. MFG. CO.,
Boston, Mass.

Cat. No. 116½.



Cat. No. 418.

"P. & S." weatherproof sockets, 3 A. 250 V. Pendant style, porcelain shell, Cat. No. 116; composition shell, Nos. 60666 and 60666A. Bracket style, porcelain shell, Cat. Nos. 0-116½ and 116½. Pendant style for festoon work, Cat. Nos. 418, 420 and 420-A to F inclusive. with supporting cleat and hook No. 430.

Approved Sept. 21, '08.

PASS & SEYMOUR, INC.,
Solvay, N. Y.

SOCKETS,—WEATHERPROOF—(Continued,) SOCKETS, MINIATURE and SOCKETS, SPECIAL.

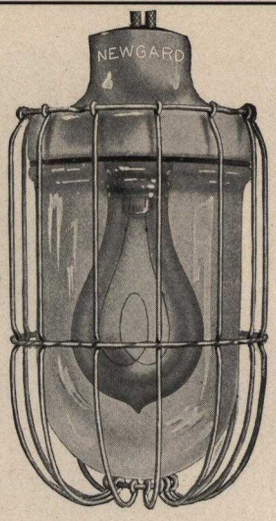
No. 303 Socket

No. 302 Socket

FEDERAL CLAMP SOCKETS

Made of one piece best vitrified porcelain. Metal clamping ring screws onto threads on the porcelain.
Lamp shells are of fine copper and are renewable from the front. For use in all kinds of sheet metal work.
Approved Nov. 29, '04.

FEDERAL ELECTRIC CO.,
Chicago, Ill.



"Newgard" weatherproof socket with vaporproof globe.

Approved June 10, '08.

AMERICAN ELECTRICAL SUPPLY CO.,
Chicago, Ill.

Composition weatherproof socket, Cat. No. 60666. 3 A., 250 V. Approved Apr. 25, '08.
(Cuts not available.)

DICKINSON MFG. CO., Springfield, Mass.

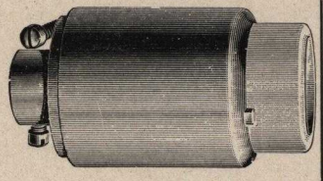
"Knowles." Cat. Nos. 9366 and 9366 spherical, 3 A., 250 V. Approved Sept. 26, '07.
(Cuts not available.)

C. S. KNOWLES, 7 Arch St., Boston, Mass.

"Memco." Porcelain pendant style, Cut. No. 1024. Approved Sept. 26, '07.
(Cuts not available.)

MECHANICAL & ELECTRICAL MFG. CO., Chicago, Ill.

SOCKETS,—MINIATURE.

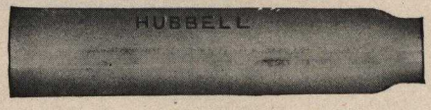


"Mitchell-Vance."
Approved Dec. 16, '04.

MITCHELL-VANCE CO.,
New York, N. Y.

Candelabra Pull Socket. Cat. No. 5455.

Candelabra Extension



Candle

Collar

Hubbell Candelabra, Pull Socket, ½ A. 125 V. Candelabra extensions, ½ A. 250 V. Approved Apr. 26, '07.

HARVEY HUBBELL,
Bridgeport, Conn.

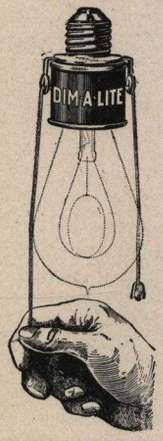
Cat. No. 9444.

G. E. Candelabra Socket, No. 1

Approved for use only in connection with porcelain candle. Approved Nov. 21, '04.

GENERAL ELECTRIC CO.,
Schenectady, N. Y.

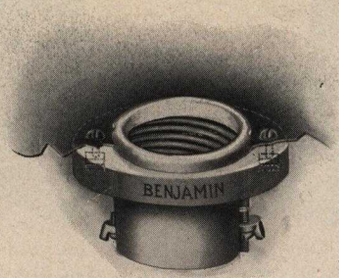
SOCKETS,—SPECIAL.



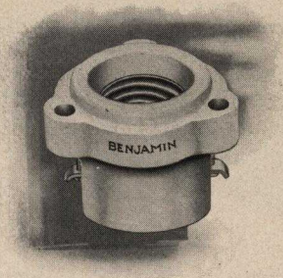
"Dimalite" Turn Down Socket. A lamp holder with screw plug attachment having a resistance suitably enclosed by means of which regulation of incandescent lamp is secured. Approved only for use with 16 c. p. lamps at 125 volts or less. Approved Mar. 31, '08.

CHAS. WIRT & CO., Philadelphia, Pa.

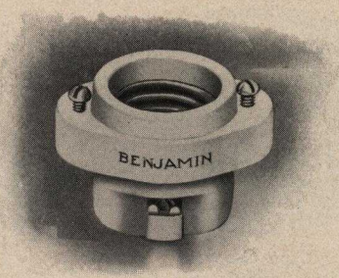
RECEPTACLES,—STANDARD.



Cat. No. 6.



Cat. No. 6S.



Cat. No. 6B.

"Benjamin" Sign Receptacles, Cat. Nos. 6 and 6-S, 3 A., 250 V. Price $0.20.

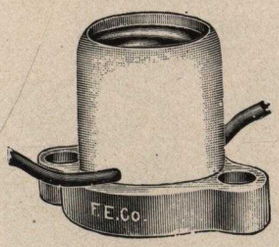
These receptacles are designed for metal sign work. The former is supported by two bolts, the latter by three, enabling the socket to be placed in any of three positions to facilitate wiring. Std. pkg. 100. Approved May 19, 1906.

"Benjamin" receptacle for outlet boxes, Cat. No. 6-B, with or without cover. 3 A., 250 V. Contacts do not project beyond walls of receptacle, therefore can not come in contact with metal parts of box or projecting parts of conduit. Std. pkg. 100.

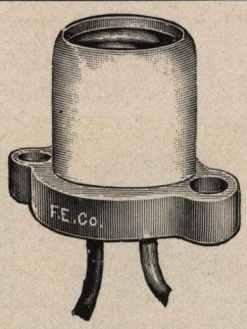
Cat. No.	Description	Price
6	Sign Receptacle with Bolts	$0.20
6S	Sign Receptacle with Bolts	.20
6B	Outlet Box Receptacle with Bolts	.20

Cat. No.	Description	Price
3623	Steel Plate only for 3-in. Outlet Box	$0.10
3624	Steel Plate only for 4-in. Outlet Box	.12
3623B	Plate with Polished Brass Cover, 3-in. Outlet Box	.20
3624B	Plate with Polished Brass Cover, 4-in. Outlet Box	.25

BENJAMIN ELECTRIC MFG. CO., 42 West Jackson Blvd., Chicago, Ill.



Cat. No. 210.



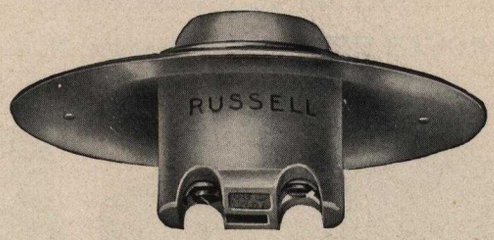
Cat. No. 212.

Outlet Box Receptacle, Cat. No. 210 with ½ inch base for conduit boxes only. This receptacle will fit Bossert outlet boxes Nos. 8-N and covers, 57 and 71.

Receptacle No. 211 is same as the No. 210 except it has 1 inch base and is used for weatherproof cleat and knob work. Cat. No. 212 weatherproof sign receptacle, Edison base. Packed 10 in box, 100 in case.

List prices No. 210 and No. 212, 25c; No. 211, 28c.

Approved March 31, 1908.



"Russell" two-piece porcelain sign receptacle, Cat. No. 276, 3 amp. 250 volt, Edison base for 1½ inch hole.

This receptacle is used for metal face signs or for outlet boxes to be fastened to the covers. They are installed by placing the small porcelain piece through hole in face of sign or opening in cover and the larger piece on back and tightening center contact screw.

No. 276 will fit Bossert iron cover No. 54 and brass No. 56, and T. & B. iron cover No. 9 C. S.

Packed 10 in a box, 250 in a case.

List price 24c. each.

Approved March 31, 1908.

E. H. FREEMAN ELECTRIC CO., Trenton, N. J.

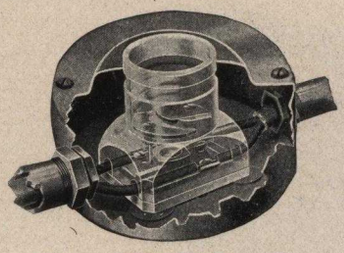
C. E. M. Co. Cat. No. 1225, for signs or conduit boxes. Approved Dec. 7, '06.

CONNECTICUT ELEC. MFG. CO., Bantam, Conn.

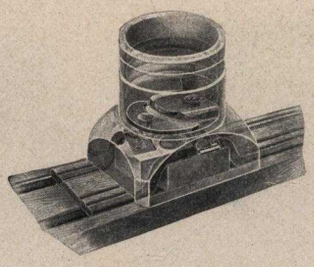
Marshall, Edison base, 50 c. p., 250 V., cleat type, Cat. No. 44954. Approved Feb. 28, '07.

MARSHALL ELEC. MFG. CO., Boston, Mass.

RECEPTACLES,—STANDARD—(Continued).



Type C-227.
"Norbitt" Conduit and Sign Receptacle.



Type A-227.
"Norbitt" Moulding Receptacle.

These Receptacles are made in two pieces—cap and base. The base is secured to the conduit box, sign or moulding and the electrical connections made, after which the cap is attached.

The fastening screws cannot fall out during installations, and the cap covers all exposed wiring connections.

With the moulding type, no mitering or forming of moulding or cap of moulding is necessary. The conduit and sign type does away with all taps, unused wires or slack wire in conduit or sign work. Std. pkg. 100.

Approved Nov. 13, '06.

CROUSE-HINDS CO., Syracuse, N. Y.

Cat. No. 61673

Cat. 61676

"Weber" wall receptacles, brass shell types.

Brass shell, Key, 50 c. p. 250 V., Keyless, 3 A., 250 V. Cleat type, Cat. No. 61672, key, and No. 61674, keyless. Concealed type, Cat. No. 61673, key, and No. 61675, keyless. Angle base type, Cat. No. 61676, key, and No. 61677, keyless.

Porcelain Shell types, keyless, 3A., 250 V. Cleat type, Cat. No. 61001; concealed type, Cat. No. 61000.

Key mechanism is not held in place by a screw and cannot become loose and permit lamp to burn after socket is turned off.

Screw-shell cannot be pulled out of contact by screwing lamp in hard.

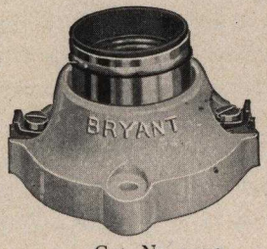
Approved Sept. 3, '08

HENRY D. SEARS, General Sales Agent., 131 State St., Boston, Mass.

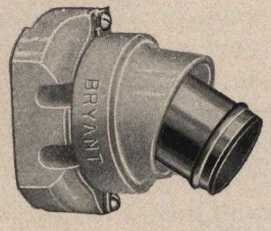
Cat. No. 1700.

Cat. No. 42453.

Cat. No. 50717.



Cat. No. 9403.



Cat. No. 9406.

"Bryant" 3 A. 250 V. Sign types, Nos. 1700, 46749 and 59108. Cleat types, Nos. 9402, 9403, 921, 1011, 1123, 50715, 11221, 28795, 58949, 58300 and 58301. Concealed types, Nos. 50744; also 9447, fusible; 2 A., 125 V. Moulding types, Nos. 42453, 58302 and 58950. Conduit box types, Nos. 9514, 9397, 40507, 40537 and 59107.

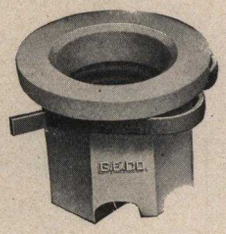
Rosette Receptacles, cleat and concealed types, fusible, 2 A. 125 V. Cat. Nos. 9434, 9436, 9438, 9404, 9405 and 9406. Approved Sept. 1, '08.

Also brass shell wall sockets, key and keyless, straight and Angle base types, Cat. Nos. 9184, 9185, 50717, slotted or closed base types and 50753 and 50755. Also wall sockets mounted on K. W. link fuse rosette base, 2 A., 125 V., cleat and concealed types; Cat. Nos. 50729, 50730, 50732 and 50733. Also above types with shade holders attached. Approved June 11, '08.

BRYANT ELECTRIC CO.,
Bridgeport, Conn.

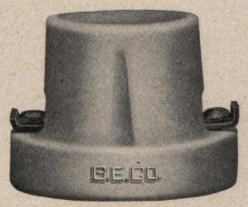
Cat. No. 50717.

Cat. No. 9185.



Cat. No. 46627.

Cat. No. 50753.

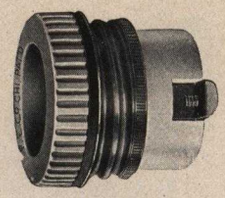


Cat. No. 28795.

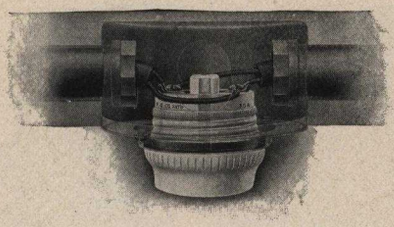
G. E. porcelain shell, keyless, 3 A., 250 V. Cleat type, Nos. 28794, 28795, 11221 and 59275. Concealed type, Nos. 50744, 50717 and 49355. Conduit types, Nos. 9397, 40537, 49354 and 9514. Sign receptacle No. 46627. Also wall sockets, brass shell, key and keyless; concealed base, Nos. 9184, 27742, 29404, 9185, 27743 and 29405. Angle base type, Nos. 50753, 28721 with slotted or closed bases, and Nos. 29406, 50755, 28722 and 29407. Approved Sept. 1, '08. Also porcelain base double ended receptacle, 16 c. p., 250 V., Cat. No. 42454. Approved for service in show window and show case metal reflectors only. Approved July 9, '07. Also Cat. No. 24998, removable ring, back connected, keyless receptacle for use on switchboards, 3 A., 250 V. Approved Oct. 22, '07. Also Cat. Nos. 34152 and 42453, two piece porcelain base moulding types with and without provisions for shade holders, 3 A., 250 V. Approved Aug. 2, '07.

GENERAL ELECTRIC CO.,
Schenectady, N. Y.

RECEPTACLES,—STANDARD—(Continued).



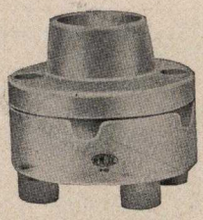
Cat. No. 301



Cat. No. 304.

Cat. No. 305.

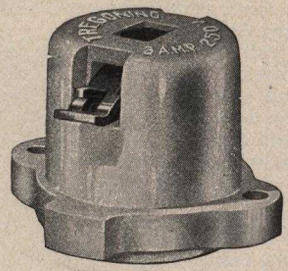
Federal Clamp Sockets. Made of one piece best vitrified porcelain. Metal clamping ring screws onto threads on the porcelain. Lamp Shells are of pure copper and are renewable from the front. For use in all kinds of sheet metal work. Approved March 12, '06. **FEDERAL ELECTRIC CO., Chicago, Ill.**



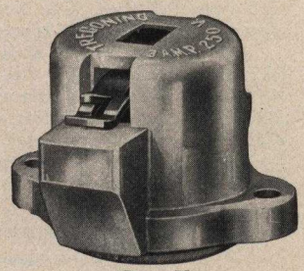
No. 1000.

"Newcode" Porcelain Cleat No. 1000. Flush Sign Receptacle No. 1020. Approved Jan. 11, '06. Std. pkg. 250.

STANLEY & PATTERSON, New York, N. Y.



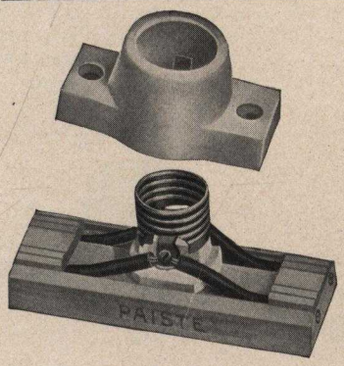
Cat. No. 300.



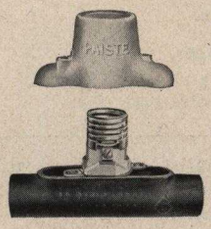
Cat. No. 301.

Tregoning Sign Receptacles, Cat. Nos. 300, 301 and 302, 3 A., 250 V. Approved Apr. 24, '08.

TREGONING ELECTRIC MFG. CO., Cleveland, Ohio.



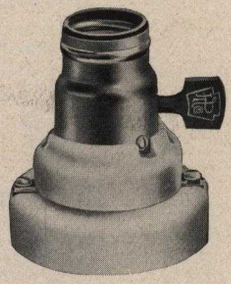
Cat. No. 50724.



Cat. No. 46555.

Cat. No. 9402.

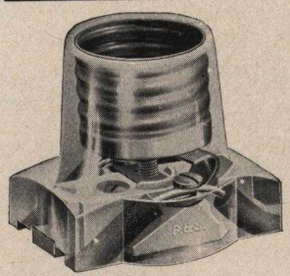
Cat. No. 47567.



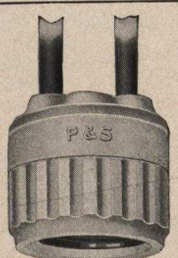
Cat. No. 50729.

"Fielding" Receptacles. For two-wire moulding, Nos. 50724 and 50726. For three-wire molding, No. 36519. For use with Condulets, Nos. 46555 and 47696. Approved May 22, '08. Also Wall Sockets mounted on P. K. or K. W. link fuse rosette bases, 2 A., 125 V., brass shell, key or keyless. Cleat types Nos. 50730, 50733, 34194, 34197. Concealed types, Nos. 50729, 50732, 34193, 34196. Porcelain shell Nos. 38135, 38136, 38394 and 38395. Also above types with shade holders attached. Approved May 12, '08. Also brass shell, porcelain base wall sockets; key, 50 c. p., 250 V., keyless, 3 A., 250 V. Cat. Nos. 9184 and 9185. Approved Aug. 7, '08. Also sign receptacles, Nos. 1700, 40488, 46749 and "Russell" No. 59439. Cleat types, Nos. 9402, 9403, 50715 and 11221. Moulding types, Nos. 47567 and 47568. Conduit box types, Nos. 9397, 40507 and "Russell" No. 46566. Approved July 5, '08.

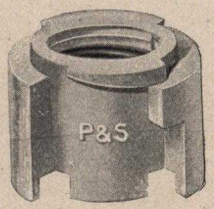
H. T. PAISTE CO., 32nd & Arch Sts., Philadelphia, Pa.



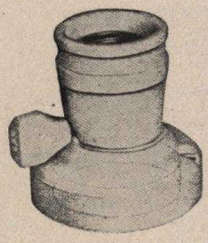
Cat. No. 770.



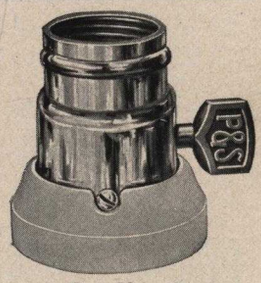
Cat. No. 577.



Cat. No. 975.



No. 247, Key.



Cat. No. 387.

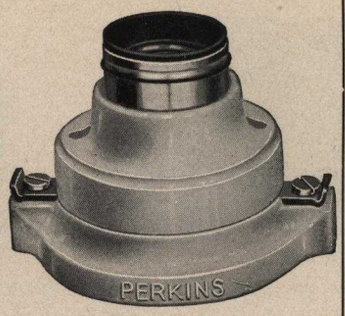
"P. & S." Receptacles, 3 A., 250 V. Cleat type, Nos. 870 and 871. Moulding types, Nos. 670 and 770. Removable ring types, Nos. 577, 578, 877, 988. Sign Receptacles, Nos. 973, 977, 975, 777, 1072. Cat. Nos. 960 and 960-A to F incl., porcelain sign receptacles having lead wires soldered to terminals and sealed. Receptacles spaced on wires from 3 to 10 inches. Cat. No. 900, a double porcelain receptacle for use only in borders or double faced metal panel signs. Approved May 18, '08.

Also "P. & S." Wall Sockets, 3 A., 250 V. (keyless) and 50 c. p., 250 V. (key). Brass shell, Nos. 387, 0387, 455, 456 and 61066 to 61068 incl. with metal keys. Porcelain shell, Nos. 2371, 02371, 237, 0237, 247, 0247, 1087, 107. Approved July 21, '08.

PASS & SEYMOUR, INC., Solvay, N. Y.

RECEPTACLES,—STANDARD—(Continued).

Cat. No. 25094.



Cat. No. 25991.

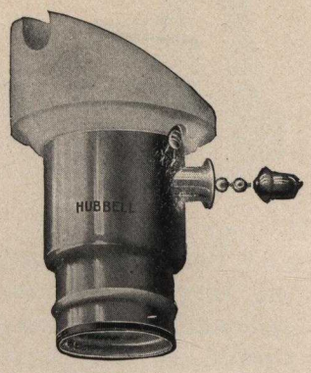
"Thomas" rosette receptacles. Standard receptacles. Edison and T. H. types on Thomas fusible rosette bases, cleat and concealed types. Cat. Nos. 25094, 25092, 3325, 3326, 26093, 25091, 3331 and 3332. Approved Aug. 27, '06.

Also "Perkins" brass shell wall sockets; key, 50 c. p., 250 V.; keyless, 3 A., 250 V. Cat. Noss. 9184-P and 9185-P, slotted or closed base types. Also wall sockets mounted on Thomas link fuse rosette bases, cleat and concealed types, 2 A., 125 V. Cat. Nos. 24990, 24991, 24993 and 24994.

Also all of the above types with shade holders attached. Approved Sept. 14, '08.

PERKINS ELECTRIC SWITCH MFG. CO.,
Bridgeport, Conn.

Cat. No. 35028.



Cat. No. 35021.

"Hubbell" wall sockets, Cat. Nos. 35006, 35028 and angle wall socket 35021, 50 c. p., 250 V.

Approved Nov. 8, '07.

HARVEY HUBBELL, INC.,
Bridgeport, Conn.

Cat. No. 9170

For Electric Signs.
Approved Oct. 23, '05.

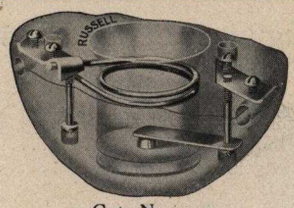
PERU ELECTRIC MFG. CO., Peru, Ind.

"Memco" Cat. Nos. 94526, 94527, 94528, 94531, 94532. Standard receptacles attached to fibre lined metal covers for use in conduit boxes. Approved July 5, 1908.

(Cuts not available.)

MECHANICAL & ELECTRICAL MFG. CO.,
Chicago, Ill.

RECEPTACLES,—WEATHERPROOF.



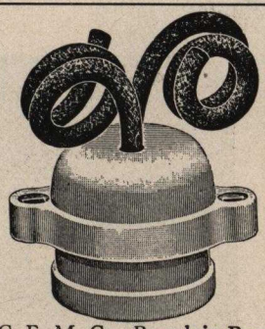
Cat. No. 240

Russell Weatherproof Receptacle. This receptacle is intended for outdoor illumination and has a separation between parts of opposite polarity of not less than ½ inch. The lamp terminals are all of heavy phosphor bronze and will not corrode.

Packed 10 in box and 250 in case. List price 28c.

Approved Sept. 5, 1908.

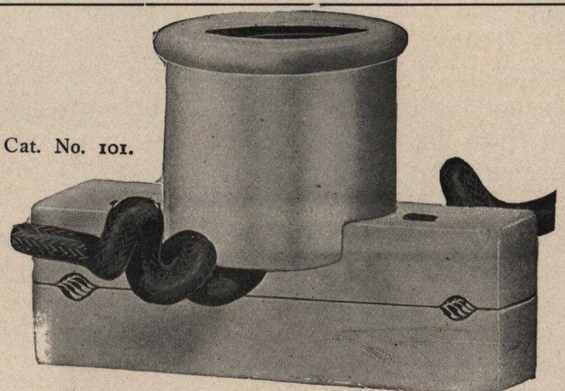
E. H. FREEMAN ELECTRIC CO., Trenton, N. J.



C. E. M. Co., Porcelain Receptacle, Cat. No. 1225, 3 A., 250 V. Approved June 18, '07. Std. pkg. 250.

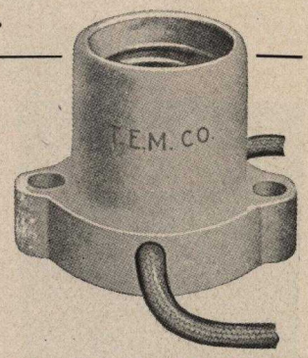
CONN. ELEC. MFG. CO., Bantam, Conn.

Cat. No. 101.



Combined cleat and receptacle, weatherproof type, Cat. Nos. 101, 102 and 103. Approved Mar. 10, '08.

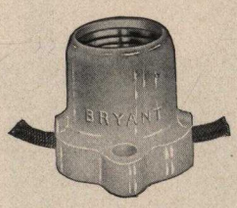
ELECTRICAL PRODUCTS CO., Morristown, N. J.



"Trumbull" Conduit Box Receptacle. Cat. No. 976, 3 A., 250 V. Arranged to fit Bossert outlet boxes, No. 8-N.

Approved Aug. 20, '07.

TRUMBULL ELEC. MFG. CO., Plainville, Conn.



Cat. No. 44912

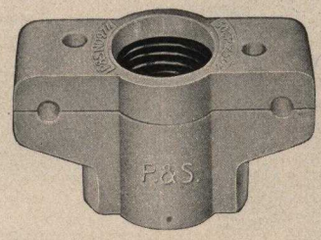
Cat. No. 9408.

Cat. No. 25706.

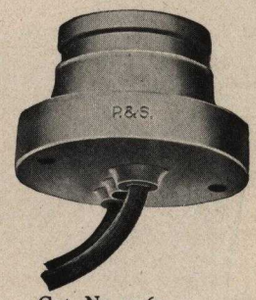
Cat. No. 25707.

"Bryant." Cat. Nos. 9407, 9408, 9411, 30000, 44912 and cleat type 59275. Also Street Hood Sockets, Nos. 25706 and 25707. Approved May 11, '08.

BRYANT ELECTRIC CO., Bridgeport Conn.



Cat. No. 971.



Cat. No. 1160.

"P. & S." Cat. Nos. 1160, 1161, 972, 974 and 1163. Cat. No. 1162, a porcelain sub-base for use with Nos. 1160 and 1161; also Cat. Nos. 820 and 971 for indoor and outdoor use.

Approved Sept. 10, '07.

PASS & SEYMOUR, INC., Solvay, N. Y.

"Paiste" Weatherproof Receptacles, Cat. No. 9408, 3 A., 250 V., with bottom wires; Cat. No. 9407, 3 A., 250 V., with side wires entering one inch from bottom surface of receptacle.

Approved June 22, '08.

H. T. PAISTE CO., Philadelphia, Pa.

G. E. Rosette Receptacle, cleat type, Cat. No. 40449, 3 A., 250 V. Approved for outdoor use only.

Approved Aug. 20, '07.

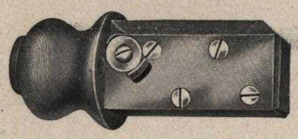
GENERAL ELECTRIC CO., Schenectady, N. Y.

"Federal" Cat. No. 308. Approved Sept. 3, '07.
(Cut not available.)

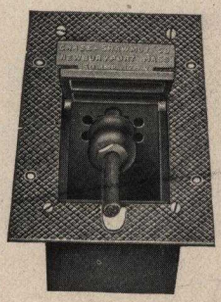
FEDERAL ELECTRIC CO., Chicago, Ill.

"Cushing" Stage Pockets and Plugs.

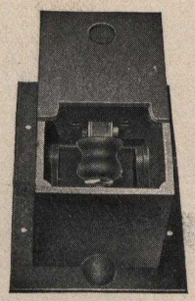
Cat. No.	50 A., 250 V. Style	List Price Each
3655	Single Pocket	$13.00
3656	Double Pocket	20.00
3657	Attachment Plug	3.00



Cat. No. 3657



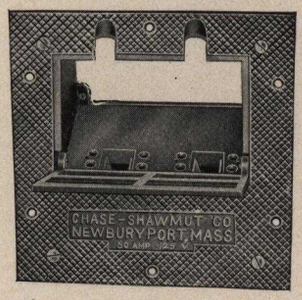
Cat. No. 3655
Top View.



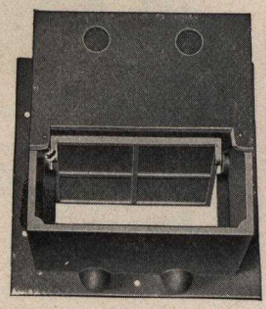
Cat. No. 3655
Bottom View.

These pockets are made both single and double and are fire-proof and unfused. The current carrying parts are mounted on slate securely clamped in the box and are in a separate closed compartment. This slate can be easily removed from the box after the pocket is installed. Lid cannot be left open. Notches in frame for cable. Section of box which is open from the top has a clear passage through to prevent the accumulation of dirt. Bottom of box drilled for ¾ inch conduit.

The boxwood attachment plug is so shaped that it can enter pocket but one way, thus preventing polarity being changed when used for D. C. arc lighting. No strain on wire terminals. Approved Aug. 20, '07.

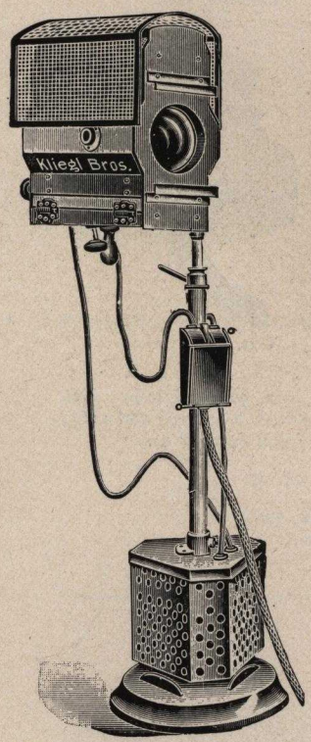


Cat. No. 3656
Top View.



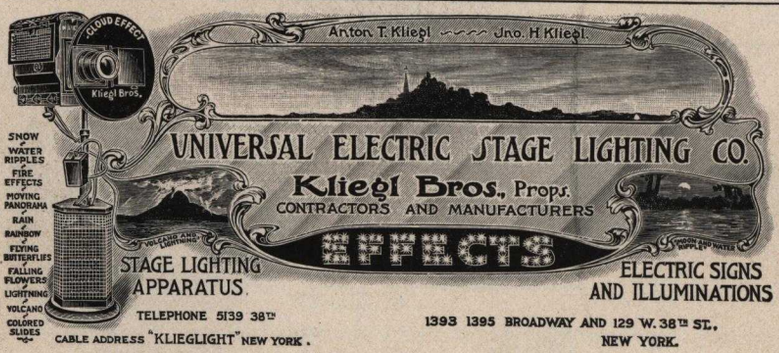
Cat. No. 3656
Bottom View.

CHASE-SHAWMUT CO., Newburyport, Mass.



Lens Box Arc Lamp on a standard, carrying knife switch and rheostat, each enclosed in an iron box. 30 A., 125 V.

Approved Oct. 13, '07.



Everything Electrical for Theatres

Border Lights—Foot Lights—Proscenium Lights—Strip and Bunch Lights.

Figure 301. Universal Plug. for use with all stage, floor and charging pockets.

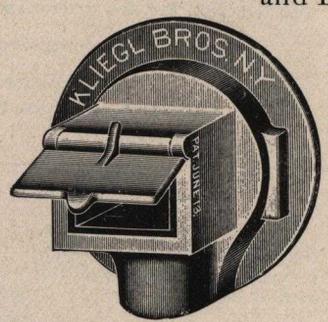


Figure 305. 50 Amp. 125 V. Automobile charging pockets. Flush Wall Pockets.

Cat. No. 310— 50A. 125 V.
Cat. No. 311— 50A. 125 V.
Cat. No. 315—100 A. 125 V.
Approved July 30, '08.

Cat. No. 217—2-gang.
Cat. No. 218—3-gang.
Cat. No. 219—4-gang.
Cat. No. 301—Plug.
Approved June 8, '08.

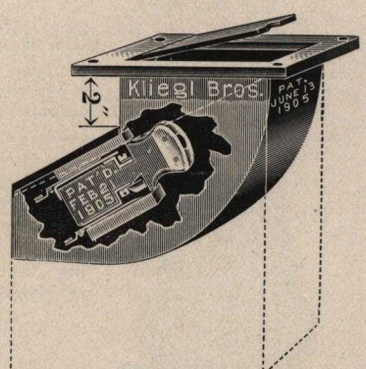
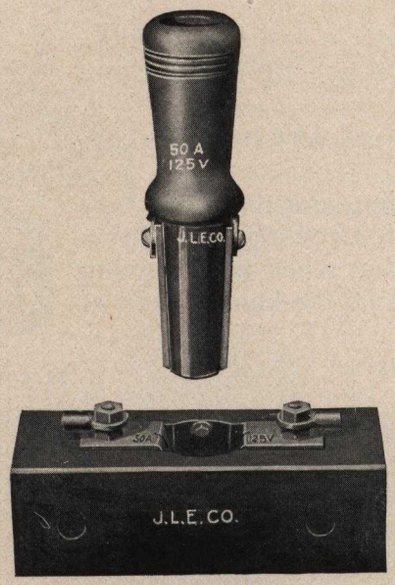


Figure 216. 50 Amp. 125 V. Single Flush Stage Pocket and Plug.

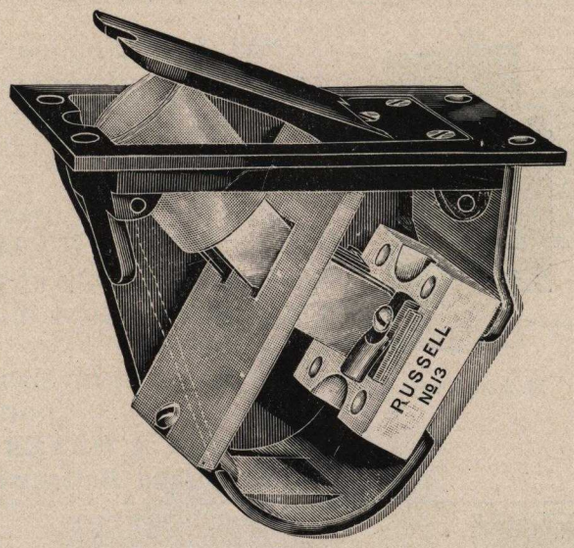
UNIVERSAL ELECTRIC STAGE LIGHTING CO., (Kliegl Bros., Props.)
1393-1395 Broadway, New York.



Lang Style "K" Stage Receptacle and plug, 125 and 250 V. Base of single piece of hard porcelain or alberine stone. Hard-wood plug for stage cable. For use in suitable iron or steel box.

Approved April 13, '08.

J. LANG ELECTRIC CO.,
116 N. Lincoln St., Chicago ,Ill.



"Russell" Stage Pocket and Plug. Cat. No. 13, 50 A., 125 V., with heavy fibre non-reversible plug, heavy copper contacts. Closing of hinged door forces plug into place. Single or gang types.

Complete Pocket with Plug, List price, $10.00.

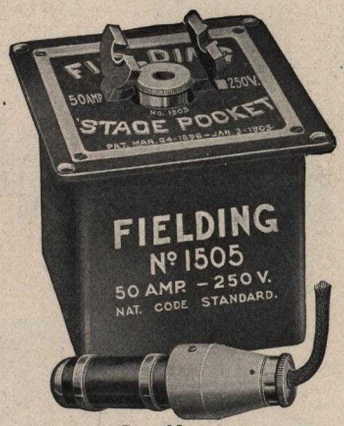
Approved April 13, '08.

RUSSELL & STOLL CO.,
46 Cliff St., New York, N. Y.

Cat. No. 1500.

Fielding receptacle and plug, 50 A., 250 V. Charging receptacle, Cat. No. 1500. Stage receptacle No. 1505. Approved Aug. 20, '07.

STANLEY & PATTERSON,
23 Murray St., New York, N. Y.



Cat. No. 1505.

RECEPTACLES,—MINIATURE.

Cat. No. 9445.

Cat. No. 9446.

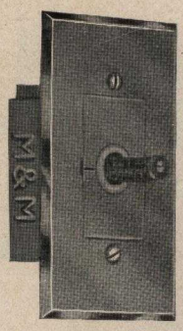
G. E. Cat. Nos. 9445 and 9446. Miniature and candelabra types respectively; cleat type porcelain base receptacle, ½ A., 125 V. Approved Nov. 2, '07.

GENERAL ELECTRIC CO.,
Schenectady, N. Y.

P. & S. candelabra sign receptacle, No. 878, ½ A., 125 V. Approved April 12, '07.

PASS & SEYMOUR, INC.,
Solvay, N. Y.

RECEPTACLES FOR ATTACHMENT PLUGS.



M. & M. Receptacle

"M. & M. Shallow Flush Receptacle and Plug, 10 A., 250 V. Receptacle only, Cat. No. 2042; Plug only, Cat. No. 2043; Plate only, Cat. No. 2044.

The receptacle is 1⅝ inches deep and very strong in construction.

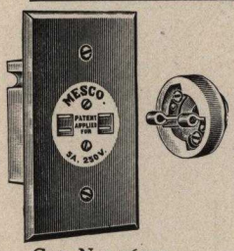
The plug is of a very heavy section, and therefore very strong, and there is a large hole in it allowing room for a knot in both strands of the cord, so that when withdrawing the plug by the cord, all strain comes on the knot instead of the terminals.

They will fit any standard wall boxes.

M. & M. Plug.

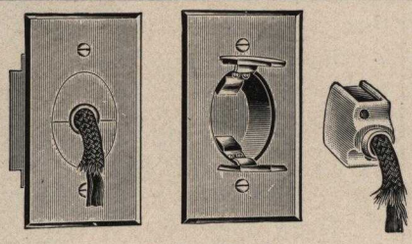
Approved Oct. 21, '07.

MACHEN & MAYER ELECTRICAL MFG. CO.,
12th and Buttonwood Sts., Philadelphia, Pa.



Cat. No. 16413.

Flush receptacle and plug, Cat. No. 16413, 5 A., 250 V. Plate sets flush with wall and is made of polished brass. Approved Sept. 10, '07.



Cat. No. 6530.

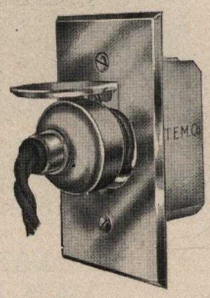
Flush receptacle and plug, Cat. No. 6530, 10 A., 250 V. Body of receptacle and plug made of porcelain, brass plate. Approved Aug. 20, '07.

MANHATTAN ELECTRICAL SUPPLY CO.,
New York, N. Y.

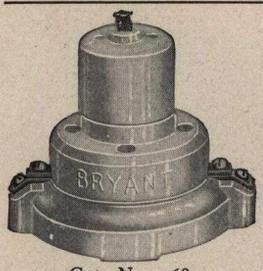
"Trumbull" flush receptacle and plug, Cat. No. 1000, 3 A., 250 V., for use with Edison type attachment plugs. Fit all standard switch boxes. Binding posts are in front making them easy to connect.

Made in nickel, old brass, polished brass, oxidized copper or dead black as desired.

Approved Aug. 15, '07.

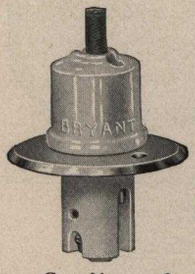


TRUMBULL ELEC. MFG. CO.,
Plainville, Conn.

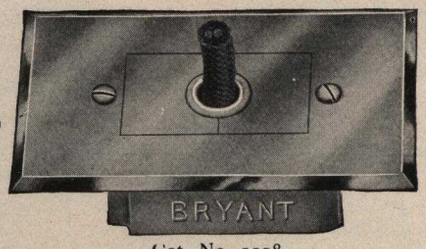


Cat. No. 1682.

Cat. No. 1708.



Cat. No. 1508



Cat. No. 1108

"Bryant" Surface Receptacles, concealed type, Cat. No. 1681, and cleat type No. 1682, mounted on K. W. link fused rosettes, 2 A., 125 V. Approved Aug. 16, '07.

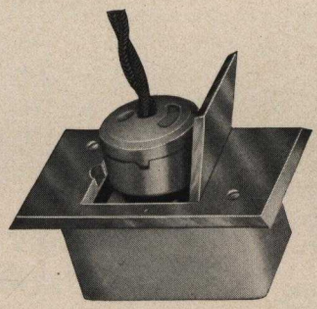
Flush receptacle, Edison type, Cat. No. 1708, 3 A., 250 V., for use with Edison type attachment plug. Approved Aug. 20, '07.

Also surface attachment plug and receptacle, 25 A., 250 V., Cat. No. 341. Also sub-base for use with this device with wooden moulding, Cat. No. 344. Approved Sept. 3, '08.

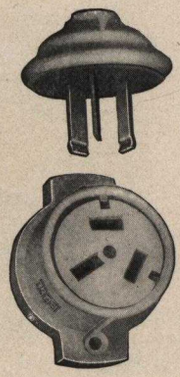
Also Chapman Flush Receptacle, Cat. No. 1108, and fuseless porcelain plug, No. 1110, 6 A., 250 V. Approved Aug. 20, '07.

Also "Bryant Junior" Flush Receptacle, Cat. No. 1508, with plug No. 1510, 3 A., 250 V. Approved Aug. 20, '07.

BRYANT ELECTRIC CO.,
Bridgeport, Conn.



Cat. No. 36817.



Cat. No. 45490.

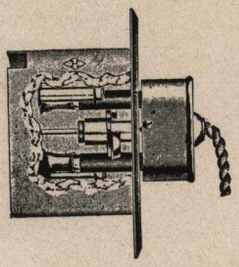
Cat. No. 45395

G. E. Flush Receptacle and Plug, Cat. No. 33441, 10 A., 125 and 250 V. Also Flush Receptacle, Cat. No. 36817, for use with Edison type attachment plug, 3 A., 250 V. Approved Sept. 1, '08.

Also Surface Receptacles with pull-off attachment plugs. Three wire, Cat. No. 45490, 25 A., 125-250 V., for use only with approved sub-base. Two wire, Cat. No. 45395, 25 A., 125 V. Approved April 6, '08.

GENERAL ELECTRIC CO.,
Schenectady, N. Y.

RECEPTACLES FOR ATTACHMENT PLUGS—(Continued).



"Diamond H." Flush Receptacle and Plug, 10 A., 250 V. Receptacle with automatic device for opening and closing holes for pins of Plugs.

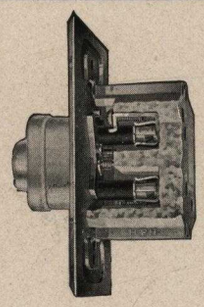
Approved Aug. 20, '07.

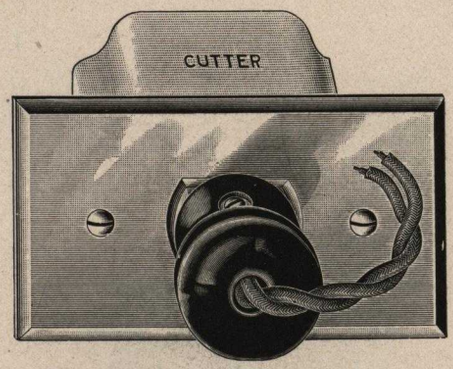
HART MFG. CO.,
Hartford, Conn.

"H. & H." Flush Receptacle and Plug, 10 A., 125 V. Automatic device for closing holes for pins in plug is provided on face plate.

Approved June 30, '08.

HART & HEGEMAN MFG. CO.,
Hartford, Conn.

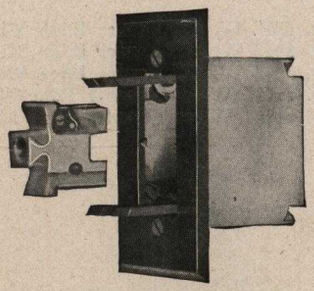




"S. F." Flush Receptacle and Plug with hole in face plate closed by inwardly opened spring shutters, 5 A., 250 V.; with hole in face plate closed by means of single door opening outward and closed by gravity, 10 A., 250 V.

Approved Nov. 8, '07.

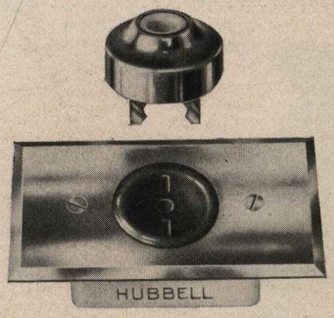
CUTTER ELECTRICAL & MFG. CO.,
Philadelphia, Pa.



M. S." Flush Receptacle and Plug, Cat. No. 971, 10 A., 250 V.

Approved Aug. 20, '07.

MARSHALL ELEC. MFG. CO.,
Boston, Mass.



Cat. No. 5415.

"Hubbell" Receptacles, 10 A., 250 V. Surface cleat types, Cat. Nos. 5512-5514 incl. Concealed type, Cat. Nos. 5426-5428 incl. Moulding type, Cat. Nos. 5540-5542 incl. Fielding, Cat. Nos. 5560, 5584 and 5585.

Flush Wall Type, Cat. Nos. 5515-5518 incl., 5543-5546 incl., and "Polarity" Cat. No. 5565.

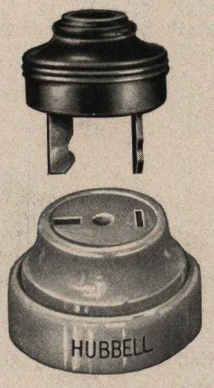
Floor Box Type, Cat. Nos. 5506-5508 incl.

Approved Sept. 30, '08.

Surface Receptacles, 20 A., 250 V. Cleat, concealed and moulding types, Cat. Nos. 5557 to 5559 incl. Flush Receptacles, 20 A., 250 V., Cat. No. 5551.

Approved April 13, '08.

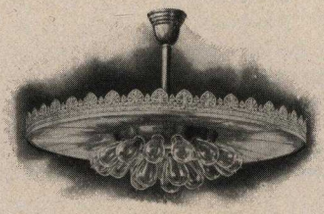
HARVEY HUBBELL, INC.,
Bridgeport, Conn.



Cat. No. 5557.

LAMP CLUSTERS.

"Benjamin" Wireless Clusters.

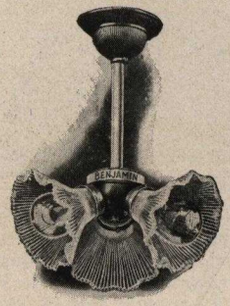


Style 0600R.—12" Stem.
Cat. No. 0620 BM.

Cat. No.		List Price
0608BM	8-Lt. 6¾" W. 24" Border Edge Mirror Refl.	$15.50
0610BM	10-Lt. 8¾" W. 24" Border Edge Mirror Refl.	16.10
0612BM	12-Lt. 8¾" W. 24" Border Edge Mirror Refl.	16.70
0615BM	15-Lt. 11¾" W. 30" Border Edge Mirror Refl.	22.20
0620BM	20-Lt. 11¾" W. 30" Border Edge Mirror Refl.	24.20

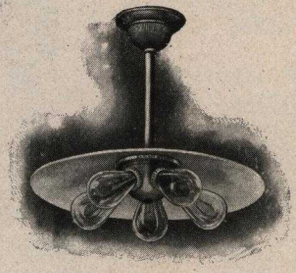
Style 02R

Cat. No.	Cat. No. 022P.	List Price
022P	2-Lt. W. 14" Opal Refl.	$2.85
023P	3-Lt. W. 14" Opal Refl.	3.10



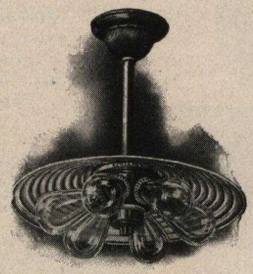
Style 02S.

Cat. No.	Cat. No. 023V.	List Price
022V	2-Lt. W. Pagoda Shades.	$3.65
023V	3-Lt. W. Pagoda Shades.	4.75



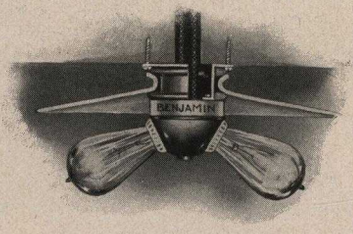
Style 01R

Cat. No.	Cat. No. 015P.	List Price
012P	2-Lt. W. 14" Opal Refl.	$3.15
013P	3-Lt. W. 14" Opal Refl.	3.40
014P	4-Lt. W. 14" Opal Refl.	3.65
015P	5-Lt. W. 14" Opal Refl.	3.90
016P	6-Lt. W. 14" Opal Refl.	4.15



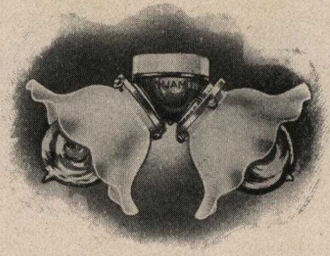
Style 07R

Cat. No.	Cat. No. 076A.	List Price
072A	2-Lt. W. 14" Alum. Refl.	$4.85
073A	3-Lt. W. 14" Alum. Refl.	5.10
074A	4-Lt. W. 14" Alum. Refl.	5.35
075A	5-Lt. W. 14" Alum. Refl.	5.60
076A	6-Lt. W. 14" Alum. Refl.	5.85



Style 200R

Cat. No.	Cat. No. 222P.	List Price
222P	2-Lt. W. Base—14" Opal Refl.	$2.45
223P	3-Lt. W. Base—14" Opal Refl.	2.70



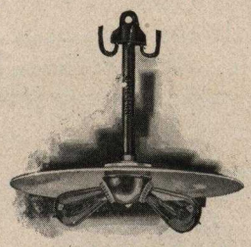
Style 2S.

Cat. No.	Cat. No. 22G	List Price
22G	2-Lt. W. Opal Shades.	$1.85
23G	3-Lt. W. Opal Shades.	2.40

BENJAMIN ELECTRIC MFG. CO., Chicago, Ill.

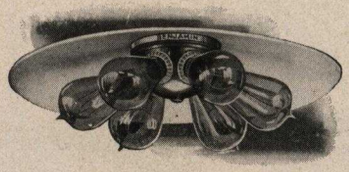
(Continued on opposite page.)

LAMP CLUSTERS—(Continued).



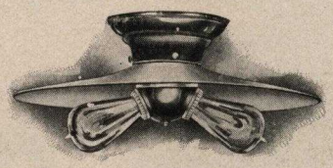
Style 601
Cat. No. 6012

Cat. No.		List Price
6012	2-Lt. Mult. or Series W. 15" Enam Steel Refl	$4.05
6013	3-Lt. Mult. or Series W. 15" Enam. Steel Refl	4.30
6014	4-Lt. Mult. or Series W. 15" Enam. Steel Refl	4.55
6015	5-Lt. Mult. or Series W. 15" Enam Steel Refl	4.80
6016	6-Lt. Mult. or Series W. 15" Enam Steel Refl	5.05



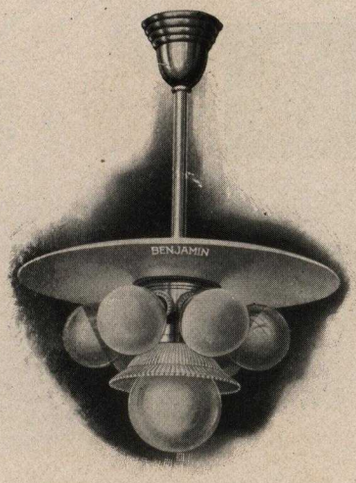
Style 1R
Cat. No. 16H.

Cat. No.		List Price
12H	2-Lt. W. 15" Enam. Steel Refl	$3.30
13H	3-Lt. W. 15" Enam. Steel Refl	3.55
14H	4-Lt. W. 15" Enam. Steel Refl	3.80
15H	5-Lt. W. 15" Enam. Steel Refl	4.05
16H	6-Lt. W. 15" Enam Steel Refl	4.30



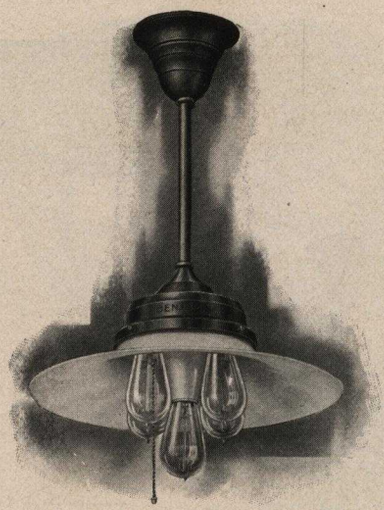
Style 32R
Cat. No. 322P.

Cat. No.		List Price
322P	2-Lt. W. Base—14" Opal Refl	$3.10
323P	3-Lt. W. Base—14" Opal Refl	3.35



Arc Bursts—25" over all
18" Opal Reflector.

Cat. No.		List Price
D43	3-Lt. Arc Burst	$7.55
D44	4-Lt. Arc-Burst	7.80
D45	5-Lt. Arc-Burst	8.05
D46	6-Lt. Arc-Burst	8.30
D47	7-Lt. Arc-Burst	8.55



Tungsten Arc—25" over all
18" Opal Reflector.

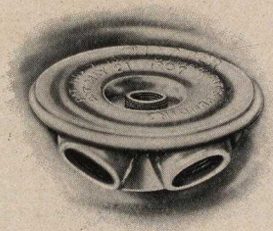
Cat. No.		List Price
T44	4-Lt. Tungsten Arc	$9.40
T45	5-Lt. Tungsten Arc	9.70
T44K	4-Lt. Tungsten Arc	9.40
T45K	5-Lt. Tungsten Arc	9.70
T46K	6-Lt. Tungsten Arc	10.00

BENJAMIN ELECTRIC MFG. CO., 42 West Jackson Blvd., Chicago, Ill.

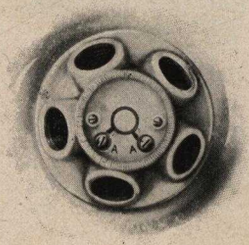
LAMP CLUSTERS—(Continued).

HARTER CLUSTERS are Opal Glass cast on Copper Contacts. They are a solid body, not affected by atmospheric conditions and can be used anywhere—inside or outside.

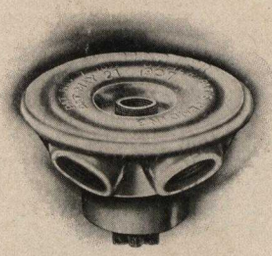
Made in either Series or Multiple. The Series Cluster is specially adapted for street car work, there being no loose or movable parts to jar out of place.



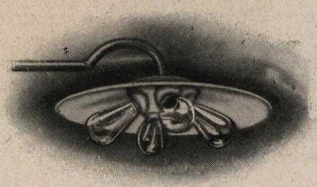
Top View of Cluster. Nipple threaded on both inside and outside. Inside thread takes ⅜" brass pipe; outside thread takes ½" conduit coupling.



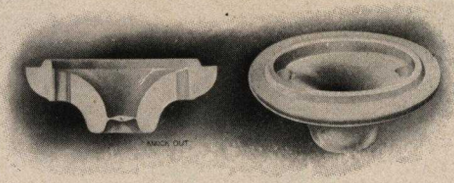
Bottom View of Cluster—Cap Removed. "A" indicates screws for attaching light wires.



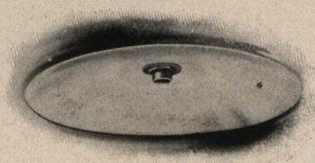
Cluster with Snap Switch Attachment.



Cluster with Goose Neck for Outdoor Construction. When Harter Steel Enameled Shades are used with Harter Clusters, no shade holder is required.

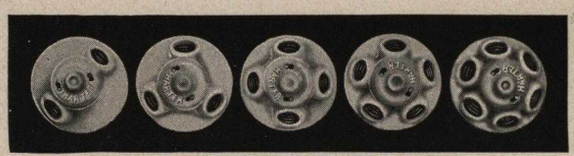


View showing Cap with thin porcelain knockout, which can be removed when Pendant Switch is used.

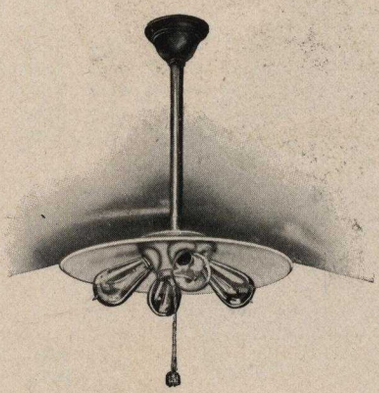


Showing Shade.

This Shade comes with nipple attached and threaded on both ends. Cluster fits on bottom, other end takes either ½" conduit or ⅜" brass tubing.



Showing Five Styles of Clusters.



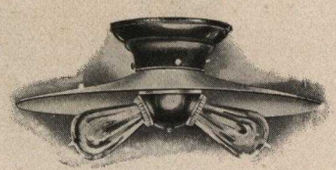
Cluster with Pendent Switch

Lt.	Multiple	Series	Weignt Std. Pkg.
2 Lt.	$1.60	$1.80	47 lbs.
3 Lt.	1.85	2.05	47½ lbs.
4 Lt.	2.10	2.30	48 lbs.
5 Lt.	2.35	2.60	48½ lbs.
6 Lt.	2.60	2.85	49 lbs.

Special Series Clusters

4 Lights, 2 lamps in series, 2 circuits	$2.55
6 Lights, 2 lamps in series, 3 circuits	3.15
6 Lights, 3 lamps in series, 2 circuits	3.15
Shade Holders for low ceilings without stems	.50
Fire Enameled Steel Shades, white, 15 inch, complete with nipple	2.00

Approved Nov. 26, '07.



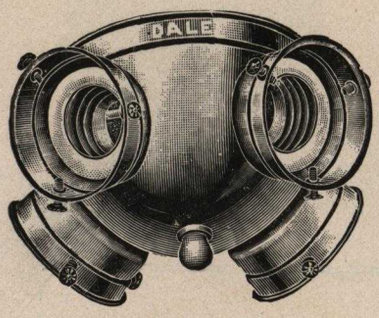
Cluster and Shade Combination.

CRESCENT COMPANY,

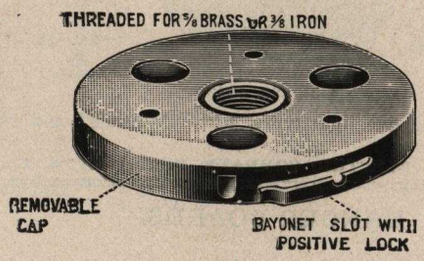
103 West Adams St. Chicago, Ill.

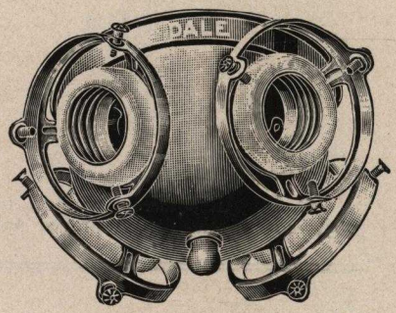
LAMP CLUSTERS—(Continued).

Dale's Wireless Clusters

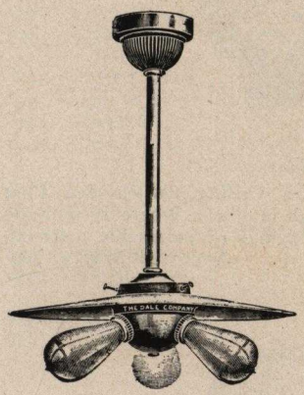


Type No. 197.
Showing 1⅝ inch holders for individual shades.

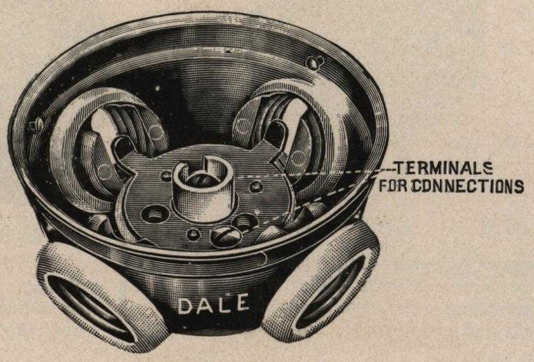




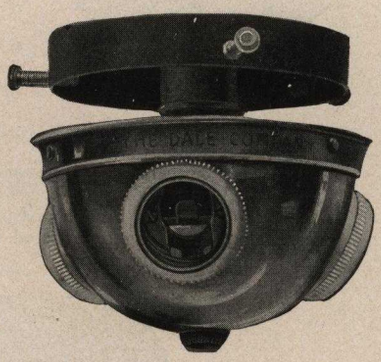
Type No. 197.
Showing 2¼ inch holders for individual shades.



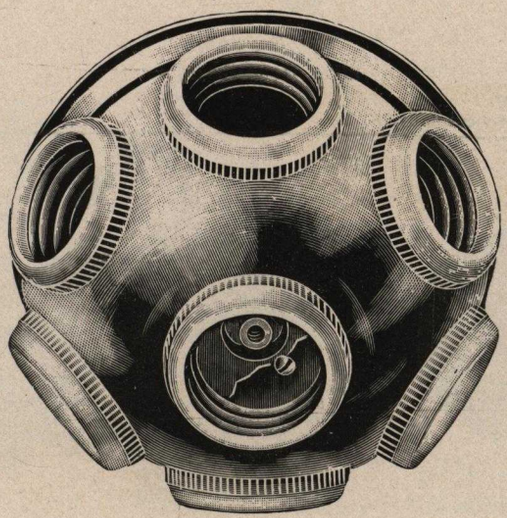
Type No. 198.
Pendant Form.



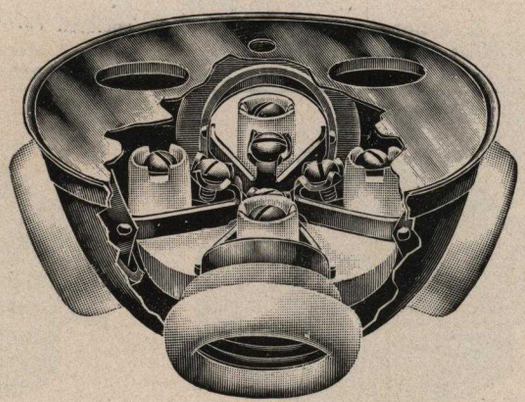
Type No. 197
Substantially a *Two Piece Cluster.*
Cut shows body and cap.



Type No. 206.
Showing ceiling flange and shade holder.



Type No. 227
Showing Light on Bottom.



Type No. 130
"Convertible" Cluster
Multiple and Series, all in one

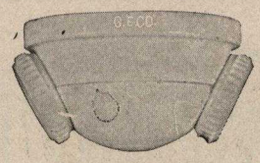
Various styles made for all purposes. Dale wireless clusters are designed with the view of making them both mechanically and electrically perfect. In wiring, it is necessary to simply remove the cap by half turn to the left, which brings the terminals in plain view and readily accessible. It is *not* necessary to remove or replace the rings to connect up.

Highest award St. Louis Exposition. Write for catalog.

Approved Feb. 10, 1908.

THE DALE COMPANY, 9th Ave., 13th & Hudson Sts., New York City.

LAMP CLUSTERS—(Continued,) and HANGER BOARDS.



Cat. No. 40518.

Cat. No. 40520.

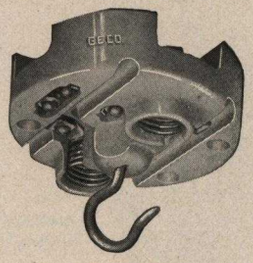
Cat. No. 40522

G. E. All porcelain wireless, two, three and five light types, both "Multiple" and "Series" connected designs, Cat. Nos. 40517-40522 inclusive. Approved April 9, '07.

GENERAL ELECTRIC COMPANY, Schenectady, N. Y.

HANGER BOARDS.

Cat. No. 2865.

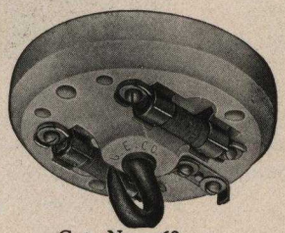


Cat. No. 44307.

G. E. porcelain base hangerboards carrying plug fuse cutouts, 30 A., 250 V. Cat. No. 2865 for concealed work, either with or without slot for branch circuit moulding. Cat. No. 44307 for concealed, moulding or exposed knob and cleat work. Std. pkg. 10. Approved Aug. 2, '07.

Cat. No. 36850.

"G. E." with Ceiling Switch and Plug Fuses. For use in places where it will not be exposed to flyings of inflamable material. Std. pkg. 10. Approved May 8, '05.



Cat. No. 36844.

G. E. equipped with 0-30 A., 250 V. enclosed cartridge fuse cutout. Std. pkg. 10.

Cat. No. 2046.

Plain Hangerboard.

Approved April 9, '07.

GENERAL ELECTRIC COMPANY, Schenectady, N. Y.

Cat. No. 4070. For cleat or open wiring.

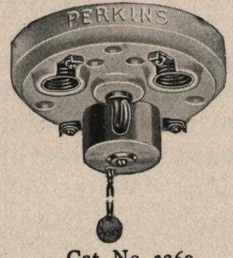
Cat. No. 4071. For concealed wiring

For Multiple Arc Lamps, equipped with plug fuse cutout extensions.

H. T. PAISTE CO., Philadelphia, Pa.

Cat. No. 4072. For moulding wiring.

Cat. No. 3226.



Cat. No. 3269.

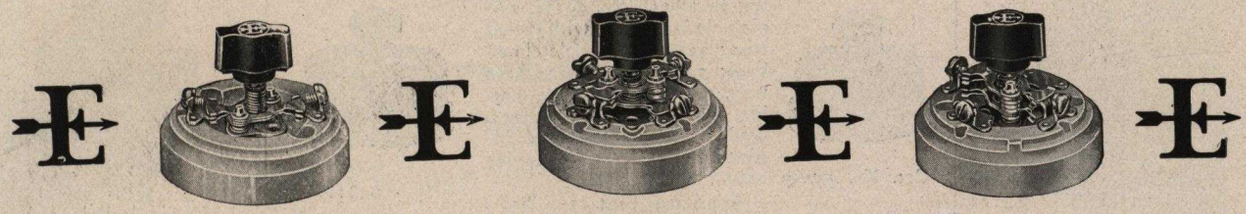
Cat. No. 3221.

No. 3226, constant potential, with plug fuses; No. 3221, plain hangerboard. Approved July 27, '05.
Arc Lamp Hanger Board, Cat. No. 3269, with pull pendant cord ceiling switch, Cat. No. 2314. Approved Sept. 26, '06.

PERKINS ELECTRIC SWITCH MFG. CO., Bridgeport, Conn.

SWITCHES,—SURFACE SNAP.

Arrow E Surface Switches.



6100 6217 6230

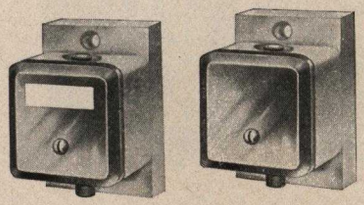
Cat. No.	5 Amp. Single Pole Pony Size.	Std. Pkg.	Price Each
6100	Open Base	250	$0.20
6101	Open Base Indicating	250	.24
6102	Closed Base	250	.20
6103	Closed Base Indicating	250	.24
	5 Amp. Single Pole.		
6200	Open Base	250	$0.24
6201	Open Base Indicating	250	.28
6202	Closed Base	250	.24
6203	Closed Base Indicating	250	.28
	10 Amp. Single Pole		
6204	Open Base	100	$0.32
6205	Open Base Indicating	100	.36
6206	Closed Base	100	.32
6207	Closed Base Indicating	100	.36
	5 Amp. Three-Point		
6225	Open Base	50	$0.45
6226	Closed Base	50	.45
	10 Amp. Three-Point		
6229	Open Base	30	$0.54
6230	Closed Base	30	.54
	10 Amp. Four-Point		
6231	Open Base		$0.66
6232	Closed Base		.66

Cat. No.	5 Amp. Double Pole	Std. Pkg.	Price Each
6208	Open Base	100	$0.56
6209	Open Base Indicating	100	.56
6210	Closed Base	100	.56
6211	Closed Base Indicating	100	.56
	10 Amp. Double Pole		
6215	Open Base	100	$0.66
6216	Open Base Indicating	100	.66
6217	Closed Base	100	.66
6218	Closed Base Indicating	100	.66
	10 Amp. Two Circuit		
6233	Open Base		$0.66
6234	Open Base Indicating		.66
6235	Closed Base		.66
6236	Closed Base Indicating		.66
	10 Amp. Three Circuit		
6237	Open Base		$0.66
6238	Open Base Indicating		.66
6239	Closed Base		.66
6240	Closed Base Indicating		.66

Approved Apr. 17, '08.

THE ARROW ELECTRIC CO., Hartford, Conn.

CUTLER-HAMMER Surface Snap Switches.



Cat. No. 7100 With Label Holder — Cat. No. 7101 Without Label Holder

Push Button Molding Switches.

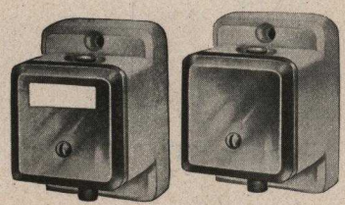
These surface switches have the same simple push-button mechanism used in the pendant switches described on page 36.

Switches for molding work are illustrated on the left. They are made exactly the same width as standard molding, permitting them to be assembled closely side by side.

Switches for concealed work are shown on the right. Both styles are made of porcelain with nickeled caps.

Capacity, 6 amperes, 125 volts, 3 amperes 250 volts. Approved July 21, '08.

Price list and discounts on application.



Cat. No. 7102. With Label Holder — Cat. No. 7103. Without Label Holder

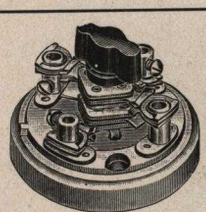
Push Button Surface Switches.

THE CUTLER-HAMMER MFG. CO., Milwaukee, Wis.

District Offices in New York, Chicago, Boston and Pittsburg. Pacific Coast Agents. Otis & Squires, San Francisco.

"Diamond H." single pole 5 A., and 10 A., 125 V.; 3 A., and 5 A., 250 V. Double pole, 5, 10, 20 and 35 A., 250 V. Three-way, 5 and 10 A., 125 V.; 3 and 5 A., 250 V. Four-way, 3 and 5 A., 125 V.; 1 and 2 A., 250 V. Electrolier, 3 and 5 A., 125 V.; 1 and 2 A., 250 V. Also above types with indicating dials or lock attachments, or both. Approved May 15, '08.

HART MANUFACTURING CO., Hartford, Conn.



Single pole and three-way, 5 and 10 A., 125 V.; 3 and 5 A., 250 V. Electrolier and four point, 3 and 5 A., 125 V.; 1 and 2 A., 250 V. Double pole, 5, 10, 20 and 35 A., 250 V. Approved April 17, '08.

HART & HEGEMAN MANUFACTURING CO., Hartford, Conn.

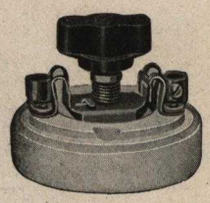
SWITCHES,—SURFACE SNAP—(Continued,) and SUB-BASES for SURFACE SNAP SWITCHES.

Cat. No. 917. Single Pole.
"Push and Pull" types, 125 V. Single pole, 15 and 25 A; double pole, 10, 15 and 25 A.
Approved March 2, '08.
BRYANT ELECTRIC CO.,
Bridgeport, Conn.

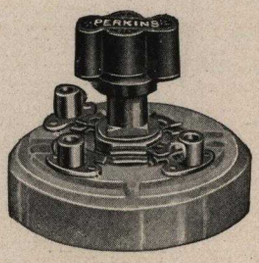
Cat. No. 34264.

Cat. No. 34444.

Indicating and non-indicating switches. No. 39134, single pole indicating with closed base; 34264 single pole closed base; 34443 and 34445, three way, closed base; 34444 double pole, closed base; 39135, double pole, closed base indicating; 21646 single pole; 21648, double pole.
Approved Sept. 19, '07.
Also single pole ceiling switches. Cat. Nos. 47092 and 47093. 5 A. 250 V.; 10 A., 125 V.
Approved July 21, '08.
GENERAL ELECTRIC CO.,
Schenectady, N. Y.



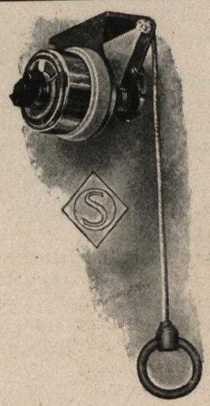
"M. S." Single Pole, 3 A. 220 V. Approved Feb. 27, '05.
MARSHALL ELEC. MFG. CO.,
Boston, Mass.



Single pole and 3 way, 5 and 10 A., 125 V.; 3 and 5 A., 250 V.; electrolier and four point, 3 and 5 A., 125 V.; 1 and 2 A., 250 V. Double pole, 5, 10, 20 and 30 A., 250 V.
Approved March 3, '08.
PERKINS ELEC. SWITCH MFG. CO.,
Bridgeport, Conn.

Jones Ceiling Attachment for "Diamond H." switch, 10 A., 250 V.
Approved Aug. 14, '06.
(Cut not available.)
JONES ELECTRICAL CO.,
New York, N. Y.

"Krantz" ceiling switch, a slightly modified approved surface snap switch mounted on a special metal frame and operated by means of a cord and gravity controlled lever.
Approved June 8, '08.
(Cut not available.)
H. KRANTZ MFG. CO.,
Brooklyn, N. Y.



Sorensen ceiling attachment for "Diamond H." switch, 10 A., 250 V.
Approved July 24, '05.
P. SORENSEN,
Brooklyn, N. Y.

SUB-BASES FOR SURFACE SNAP SWITCHES.

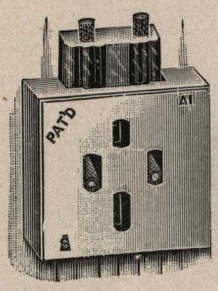


Fig. 1

THE ARMSTRONG SWITCH BLOCK

An inexpensive, absolutely safe, ornamental and labor saving device, which STRADDLES the moulding. No cutting necessary. Allowing the wires to be drawn through angle holes, and partitioned from screws which hold switch and the block in position, making it impossible for the screws and wires to come in contact.

Many types of receptacles can be used on these blocks. Wherever placed gives a finish to the work.

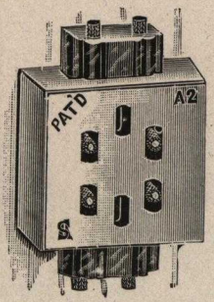


Fig. 2

Fig. 1. Shows a block for any single pole snap switch, where the moulding stops inside the block.

Fig. 2. Shows a block for single or double pole snap switch, where the moulding passes through the block.

Fig. 3. Shows a block for double pole snap switch, where the feed and circuit moulding both enter the block but do not pass through.

Fig. 4. Shows a block with the switch mounted.

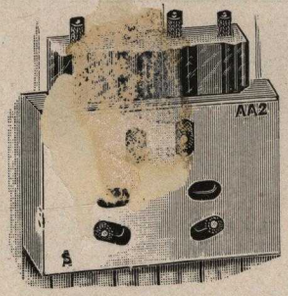


Fig. 3

No. A1. Std. pkg. 100, price $10.00 per C.
No. A2. Std. pkg. 100, price 10.00 per C.
No. AA2. Std. pkg. 100, price 15.00 per C.

Write for circulars and discounts.

Approved April 30, '1908.

FREDERICK A. ARMSTRONG,
348 Court St., Brooklyn, N. Y.

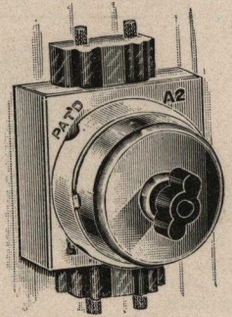


Fig. 4

SUB-BASES FOR SURFACE SNAP SWITCHES.—(Continued).

Fig. 1

D. & S.
Switch Sub-Base.

Patented July 7, '08.

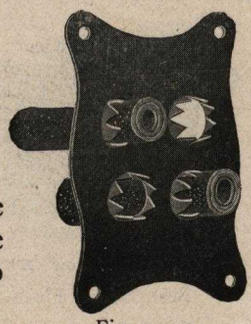


Fig. 2

The D. & S. Snap Switch sub-base is a two-piece device for concealed knob and tube wiring designed to give a secure mounting for a snap switch in lath and plaster walls and also affords an outlet and means of securing the flexible tubing.

Fig. No. 1. Shows upper plate, with lugs drilled and tapped, so situated that any snap switch can be secured to it.

Fig. No. 2. Shows lower plate punched with tooth like projections, points of which engage flexible tubing holding the same securely.

Fig. No. 3. Shows method of mounting upper and lower plates.

Fig. No. 4. Shows snap switch mounted on sub-base.

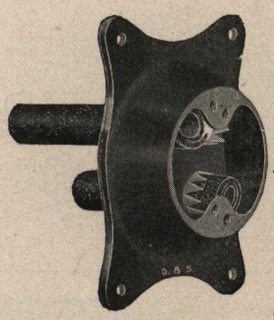


Fig. 3

In installing the D. & S. Sub-base, tubing is inserted from the under side of lower plate and secured by the teeth, the plates are then screwed to wooden cross strips that are in turn secured to upright wall timbers. Set the cross strips flush with the wall timbers which will bring the top of the upper plate flush with the plaster.

No. 31, 5 Amp., No. 32, 10 Amp.

250 or less, each $0.15. 250 to 1000, each $0.13½. 1000 and over, each $0.12.

Approved May 20, '08.

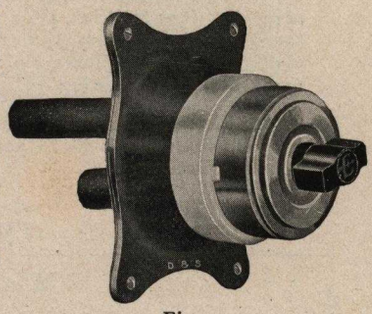
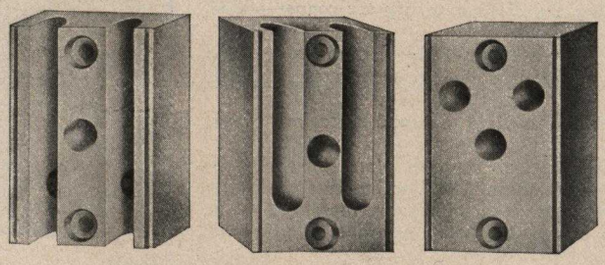


Fig. 4

THE W. G. NAGEL ELECTRIC CO., Exclusive Sales Agents, **Toledo, Ohio.**



Cat. No. 7180. Cat. No. 7181. Cat. No. 7182.

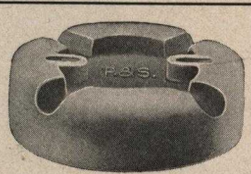
"C-H" all porcelain sub-bases for use with "C-H" surface push button switches. Cat. No. 7180, for open wiring; Cat. No. 7181, for end of molding; Cat. No. 7182, for concealed wiring. Standard color, plain white only.

Packed 20 in a box; std. pkg. 100. List price, 5c each.

THE CUTLER-HAMMER MFG. CO.,
Milwaukee, Wis.

Weber. Cat. No. 444. Round Porcelain sub-base for switches and receptacles used in exposed knob or cleat work. Approved Oct. 22, 1907.

HENRY D. SEARS, General Sales Agent,
131 State St., Boston, Mass.

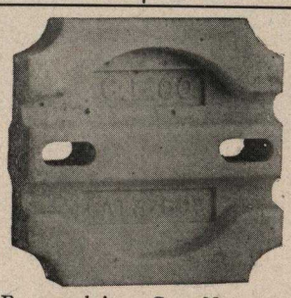


Cat. No. 16.

Porcelain, round and square types for one, two and three switches. No. 16 for open or concealed wiring; No. 17 for molding or concealed wiring; No. 18, two gang for concealed wiring; No. 19, three gang for concealed wiring.

Approved Aug. 15, '07.

PASS & SEYMOUR, INC.,
Solvay, N. Y.



G. E. porcelain. Cat. No. 37895, for switches Nos. 34264, 39134 and 34443. Cat. No. 37896 for switches Nos. 34444, 34445 and 34446.

Approved June 27, '06.

GENERAL ELECTRIC CO.,
Schenectady, N. Y.

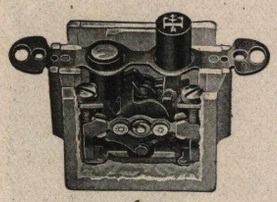
Cat. No. 23

Porcelain bases for cleat, concealed and moulding work for 5, 10, 20 and 30 A. switches.

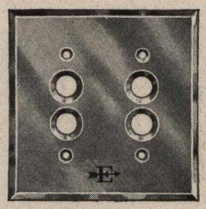
Approved April 2, '06.

PERKINS ELECTRIC SWITCH MFG. CO.,
Bridgeport, Conn.

SWITCHES, FLUSH—PUSH BUTTON AND ROTARY.



6301



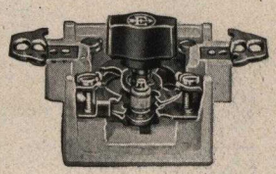
6313

"Arrow E" Push Button Flush Switches

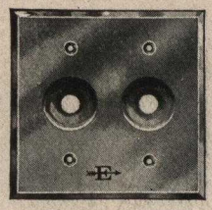
Push Button Flush Switches without Plate.

Cat. No.		Std. Pkg.	Price Each
6300	10 Amp. Single Pole	50	$1.15
6301	10 Amp. Double Pole	50	1.65
6302	10 Amp. Three Point	50	1.65
6303	10 Amp. Four Point	5	3.25
	Flush Plates for Push Button Flush Switches In One Horizontal Row		
6312	For One Switch, 4½ x 2¾ in.	100	$0.35
6313	For Two Switches, 4½ x 4-9/16 in.	100	70
6314	For Three Switches, 4½ x 6⅜ in.	100	1.05
6315	For Four Switches, 4½ x 8-3/16 in.	100	1.40
6316	For Five Switches, 4½ x 10 in.	100	1.75
6317	For Six Switches, 4½ x 11-13/16 in.	100	2.10
6318	For Seven Switches, 4½ x 13⅝ in.	100	2.45
6319	For Eight Switches, 4½ x 15-7/16 in.	100	2.80

100 Plates, or equivaler[illegible] holes make up a Standard Package; but Push Button Pl[illegible] and Rotary Plates cannot form a Standard Package.



6252



6266

"Arrow E" Rotary Flush Switches

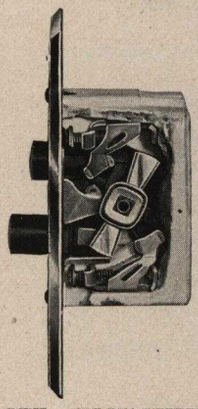
Rotary Flush Switches without Plates.

Cat. No.		Std. Pkg.	Price Each
6250	5 Amp. Single Pole	100	$0.62
6251	10 Amp. Single Pole	50	.71
6252	10 Amp. Double Pole	50	1.05
6253	5 Amp. Three Point	50	.82
6254	10 Amp. Three Point	30	1.05
6255	10 Amp. Four Point		1.05
6256	10 Amp. Two Circuit		1.05
6257	10 Amp. Three Circuit		1.05
	Flush Plates for Rotary Flush Switches In One Horizontal Row.		
6265	For One Switch, 4½ x 2¾ in.	100	$0.53
6266	For Two Switches, 4½ x 4-9/16 in.	100	1.20
6267	For Three Switches, 4½ x 6⅜ in.	100	1.80
6268	For Four Switches, 4½ x 8-3/16 in.	100	2.40
6269	For Five Switches, 4½ x 10 in.	100	3.00
6270	For Six Switches, 4½ x 11-13/16 in.	100	3.60
6271	For Seven Switches, 4½ x 13⅝ in.	100	4.20
6272	For Eight Switches, 4½ x 15-7/16 in.	100	4.80

Approved April 17, '08.

THE ARROW ELECTRIC CO., Hartford, Conn.

"M. and M." Shallowest Flush Push Button Switch.



Single pole and three-way, 10 A., 125 V.; 5 A., 250 V., Cat. Nos. 2000 and 2002. Double pole, 10 A., 250 V., Cat. No. 2001.

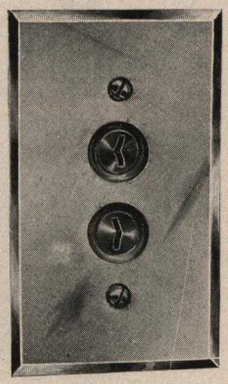
The "M. and M." Shallowest Flush Switch is only 1-7/16" deep.

The mechanism is very simple and strong in construction, all wearing parts being of case hardened steel. All wearing parts including the driving spring are copper plated, so that the mechanism is absolutely Rust Proof.

When wall boxes are used as junction boxes, they are frequently very much crowded with wires, and the shallow feature of the "M. and M." switch in such cases is of advantage.

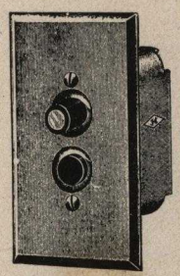
These switches have been tested to operate over two-hundred thousand makes and breaks before the driving spring broke.

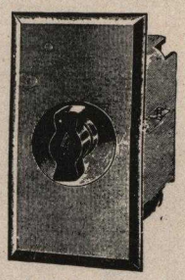
Either solid or stamped face plates are furnished. The stamped plates offer the advantage that when the wall boxes are not set flush with the plaster line but extend slightly beyond, the stamped plate will cover up this defect, also, where there are tapestries on the wall, the stamped plate will pin the edges down around the box. Approved October 21, 1907.



Face Plate for Lock Switch.

MACHEN & MAYER ELECTRICAL MFG. CO., Philadelphia, Pa.



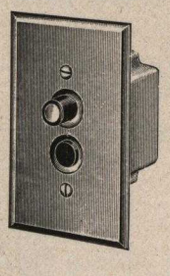


"Diamond H." Push Button Switches. Single pole, three and four-way, 10 A., 125 V.; 5 A., 250 V. Double pole, 10 A. 250 V. Also Special No. 9 for remote control solenoid operated apparatus.

Rotary Flush Switches, 5 and 10 A., 125 V.; 3 and 5 A., 250 V. Double pole, 10 A., 250 V. Three-way, 10 A., 125 V.; 5 A., 250 V. Four-way and Electrolier, 5 A. 125 V.; 2 A., 250 V.

Also above types with lock attachments. Approved May 15, '08.

HART MFG. CO., Hartford, Conn.



"H. and H." Push Button Switches, single pole, three-way and four point, 10 A., 125 V.; 5 A., 250 V. Double pole, 10 A., 250 V.

Rotary Flush Switches, single pole and three-way, 5 and 10 A., 125 V.; 3 and 5 A., 250 V. Electrolier and four point, 3 and 5 A., 125 V.; 1 and 2 A., 250 V. Double pole, 10 A., 250 V.

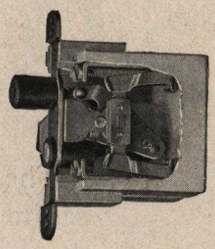
Approved April 17, '08.

HART & HEGEMAN MFG. CO., Hartford, Conn.

SWITCHES, FLUSH—PUSH BUTTON AND ROTARY.—(Continued.) and SWITCHES,—DOOR.

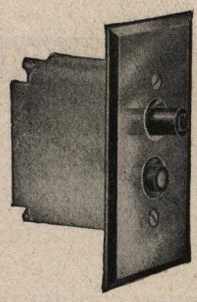
G. E. Push Button Switches. Cat. No. 36078, single pole, 5 A., and Cat. No. 36079, 10 A., 250 V. Approved Feb. 21, '06.

GENERAL ELECTRIC CO., Schenectady, N. Y.



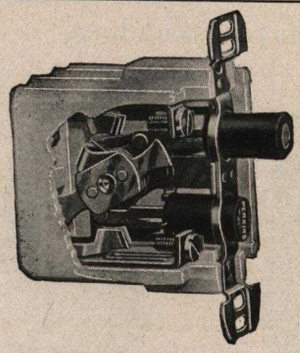
Knowles, Push Button Switches, single pole, three way and four point, 10 A., 125 V.; 5 A., 250 V. Double pole, 10 A., 250 V. Approved May 13, '08.

C. S. KNOWLES, 7 Arch St., Boston, Mass.



"M. S" Push Button Flush Switches, single pole, Cat. No. 531, 5 A., 110 V. Double pole, Cat. No. 532, 10 A., 220 V. Approved Mch. 5, '06.

MARSHALL ELEC. MFG. CO., Boston, Mass.



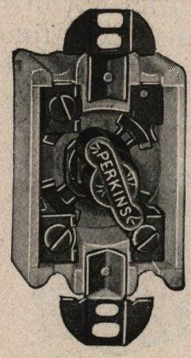
Cat. No. 2202.

Perkins Push Button Switches; single pole, three-way and four point, 10 A., 125 V.; 5 A., 250 V. Double pole, 10 A., 250 V.

Rotary Flush Switches, single pole and three-way, 5 and 10 A., 125 V., 3 and 5 A., 250 V. Electrolier and four-poi[illegible] 3 and 5 A., 125 V.; 1 and 2 A. 250 V. Double pole, 10 [illegible] 250 V.

Approved March 3, '08.

PERKINS ELECTRIC SWITCH MFG. CO., Bridgeport, Conn.

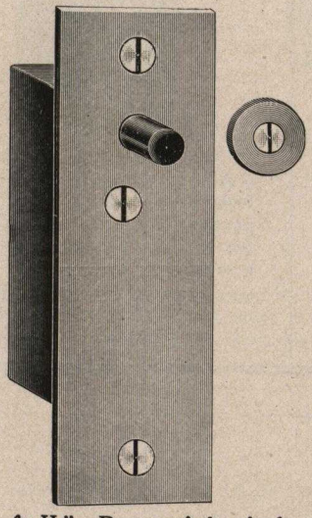


"S. F" Push Button Switches, single pole, 3 A, and double pole, 10 A., 250 V. Approved June 28, '05. "C. S," single pole, double pole and three way, 5 and 10 A., 110 V. Approved April 16, '06.

(Cuts not available.)

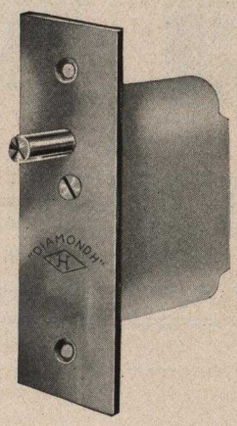
THE CUTTER ELEC. MFG. CO., Philadelphia, Pa.

SWITCHES, DOOR.



"H. & H." Door switch, single pole, 3 A., 250 V. Approved May 9, '08.
Approved for use when mounted in approved switch box.

HART & HEGEMAN MFG. CO., Hartford, Conn.



"Diamond H," door switch, 3 A. 250 V. Cat. Nos. 601 and 602. Approved April 21, '08.

HART MANUFACTURING CO., Hartford, Conn.

Perkins, 3 A., 250 V. Cat. Nos. 2355 and 2356.
Approved May 9, '08.

PERKINS ELEC. SWITCH MFG. CO., Bridgeport, Conn.

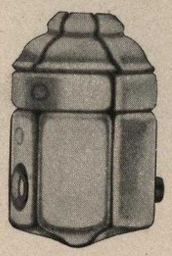
CUTLER-HAMMER Pendent Switches.

The mechanism used in these switches is note-worthy because of its extreme simplicity. It consists of but three moving parts—(1) a push-bar extending clear through the switch, (2) a coiled steel spring, and (3) a moving contact piece. These with the fixed contacts constitute the whole of the mechanism.

The contact piece makes and breaks the circuit with a positive, quick snap and the spring (tempered in oil) has stood the laboratories test of 6000 operations and factory tests many times greater than the number of operations required by the Underwriters.

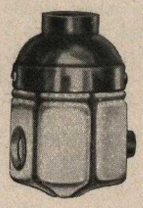
Coiled Spring—Push Bar—and Contact Piece.

The removal of a single screw gives access to the interior of these switches, making the wiring of them an easy matter. Being made of porcelain they are proof against corrosion and users of them are insured against accidental shocks. The standard colors are *White, Ivory, Brown* and *Gray,* affording a choice of colors that will harmonize with almost any surroundings.

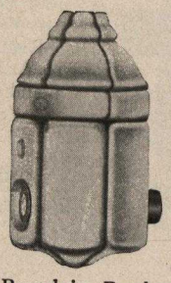


All Porcelain Pendent Switch, Cat. No. 7000, 6 A., 125 V. 2 A., 250 V.

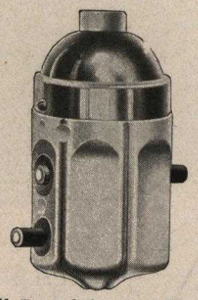
Brass Cap Pendent Switch for ⅛ in. pipe. Cat. No. 7001, 6 A, 125 V., 2 A., 250 V.



Brass Cap Pendent Switch for ⅜ in. pipe. 6 A., 125 V., 2 A., 250 V. Cat. No. 7002.



All Porcelain Pendent Switch. 10 A., 125 V., 5 A., 250 V. Cat. No. 7010.



All Porcelain two Circuit Pendent Switch. 6 A., 125 V., 2 A., 250 V. Cat. No. 7020.

Approved 1908. Price Lists and Discounts on Application.

THE CUTLER-HAMMER MFG. CO., Milwaukee, Wis.

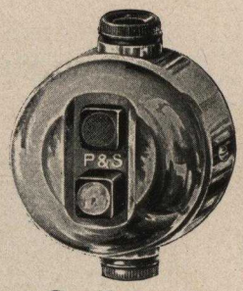
District Offices in New York, Chicago, Boston and Pittsb urg; Pacific Coast Agents, Otis & Squires, San Francisco, Cal.

Two button type, single pole, 6 A., 125 V.; 3 A., 250 V. Cat. No. 42862 with double insulating bushing; Cat. Nos. 44145 and 44146 with ⅛" and ⅜" pipe nozzles respectively.

Approved April 17, '08.

GENERAL ELECTRIC CO.,
Schenectady, N. Y.

Cat. No. 3000.



Cat. No. 3010.

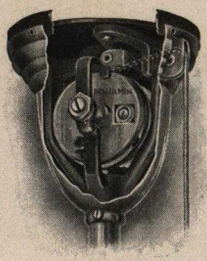
"P. & S" pendant switches, 3 A., 250 V.; 6 A., 125 V. Cat. No. 3000, single pole, two button. "Feed-Thru" switch. Cat. No. 3010.

Approved Aug. 31, '08.

PASS & SEYMOUR, INC., Solvay, N. Y.

Two button type, single pole, 6 A., 125 V.; 3 A., 250 V. Cat. Nos. 2353 and 2354 for either pendants or fixtures, and Cat. No. 2359 for pendants onlv. Approved Feb. 17, '08.

PERKINS ELEC. SWITCH MFG. CO.,
Bridgeport, Conn.

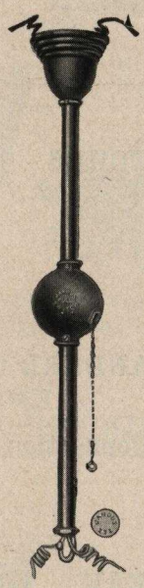


"Benjamin" Canopy Grouping Switch, 5 A. 125 V.; 2 A., 250 V. Cat. No. 3329. Adapted for conveniently and economically locating the control of any lighting fixture or bracket in which a plurality of lamps is to be operated in two groups. Two or three degrees of illumination may thus be secured without the necessity of running the usual three wires to the switches on the side walls or using two pendant switches.

Cat. No. 3329

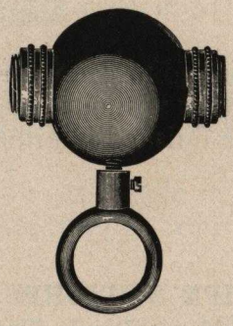
Approved Sept. 21. '08.

BENJAMIN ELECTRIC MFG. CO., 42 W. Jackson Blvd., Chicago, Ill.



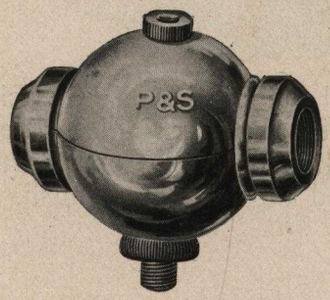
Jandus Arc Light or Chandelier. A standard approved snap switch, enclosed in a hollow spherical iron casting, to be attached to fixture and operated by pendant chain. Approved Aug. 7, '06.

THE JANDUS ELEC. CO., Cleveland, Ohio.



Mitchell-Vance. Chandelier, 4 light, 5 A, 125 V.
Vance Fixture Arm, single pole, ½ A, 125 V.
Approved Dec. 14, '04.

MITCHELL-VANCE CO., New York, N. Y.



P. & S. Key arm switch, with brass shell and fibre cap, single pole, ½ A. 125 V., Cat. No. 3200 (formerly marked "Sarco" and manufactured by The Sarco Company, New York, N. Y.) Std. pkg., 100. Approved July 25, '07.

Approved for fixture arms only (not canopies) for control of not over one 16 c. p. 110 V. lamp and when wired with solid (not stranded) wires.

PASS & SEYMOUR, INC., Solvay, N. Y.

Caldwell fixture arm, single pole, ½ A, 125 V.

Approved Apr. 2, '06.

(Cut not available.)

EDW. F. CALDWELL & CO., New York, N. Y.

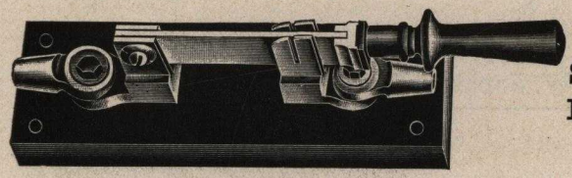
Cassidy, Chandelier, S. P., 3 A, 125 V. Multiple snap switch to be mounted in properly, lined fixture. Approved Aug. 10, '06.

(Cut not available.)

CASSIDY & SONS MFG. CO., New York, N. Y.

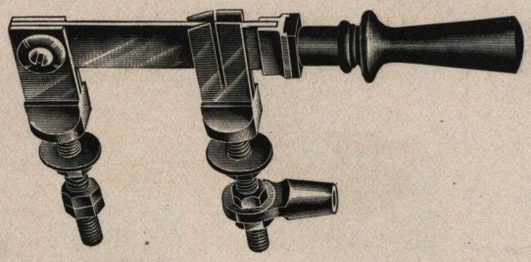
STANDARD KNIFE SWITCHES

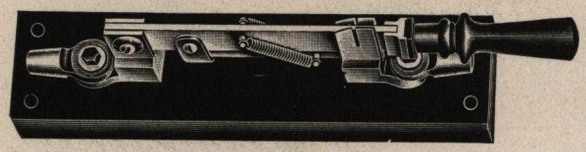
30 to 5,000 Ampere Capacity



STANDARD 250 VOLT KNIFE SWITCHES.
Front Connection--Mounted on Black Slate Bases

STANDARD 250 VOLT KNIFE SWITCHES
Back Connection—Unmounted

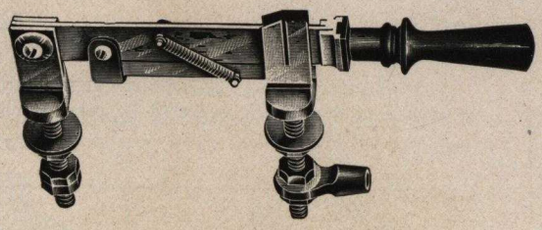




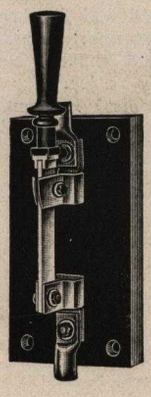
STANDARD 600 VOLT QUICK BREAK KNIFE SWITCHES
Front Connection--Mounted on Black Slate Bases

STANDARD 600 VOLT QUICK BREAK KNIFE SWITCHES

Back Connection—Unmounted



"FA" Standard Knife Switches are made from 30 to 5000 amp. capacity, inclusive, in any number of poles, single or double throw. Either without fuses, or with fuse terminals for open link or New Code Cartridge Fuses. Are finished in either dipped and lacquered or polished and lacquered finish.



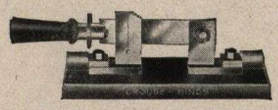
COMPETITION TYPE F KNIFE SWITCHES, 250 and 600 VOLTS
Front Connection, Mounted on Black Slate, Plain Finish.

Type "F" or Competition Knife Switches are made from 20 to 200 amp. capacity, inclusive, in any number of poles, single or double throw. Without fuses, or with fuse terminals for New Code Cartridge Fuses. The standard finish is dipped and lacquered.

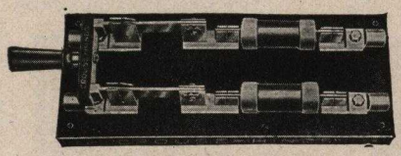
Approved Oct. 8, 1906.

FRANK ADAM ELECTRIC CO.,
St. Louis, Mo.

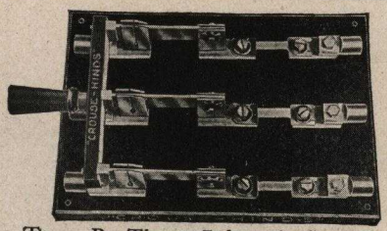
SWITCHES, KNIFE—(Continued.)



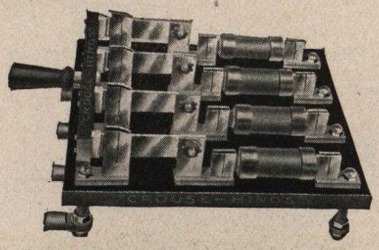
Type B—Single Pole, Single Throw Switch, no fuse. Front Connection.



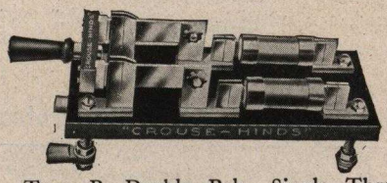
Type B—Double Pole, Single Throw Switch with Enclosed fuses. Front Connection.



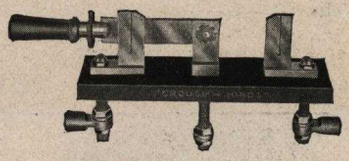
Type B—Three Pole, Single Throw Switch with Open Link fuses. Front Connection.



Type B—Four Pole Single Throw Switch with Enclosed fuses. Back Connection.

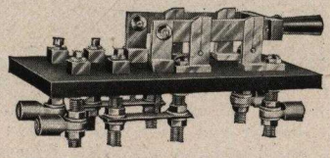


Type B—Double Pole, Single Throw Switch with Enclosed fuses. Back Connection.

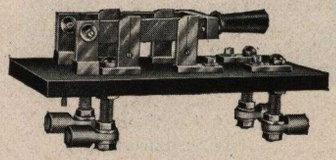


Type B—Single Pole, Double Throw Switch, no fuse. Back Connection.

Type C—Double Pole, Double Break, Single Throw Switch, Fused. Front Connection.



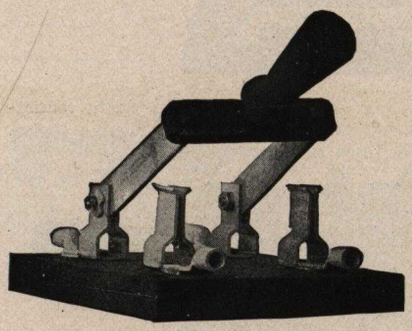
Type D—Double Pole, Double Break, Single Throw, Fused. Back Connection.



Type E—Double Pole, Double Break, Single Throw, Fused. Back Connection.

"Crouse-Hinds" Types B, C, D, and E. All capacities, 250 volts. Approved Nov. 25, '04.

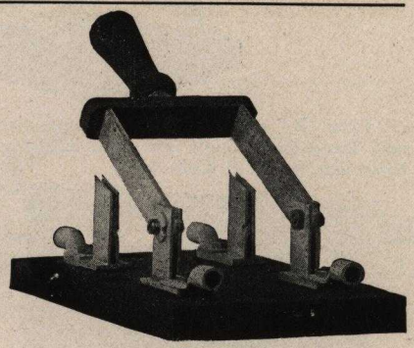
CROUSE-HINDS CO., Syracuse, N. Y.



Mascot.

Tower Binford Knife Switches, 125, 250 and 600 V. All capacities, with or without fuse extensions.

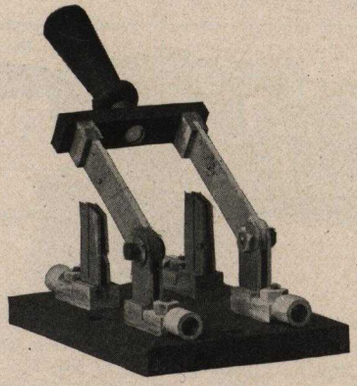
The switches listed here are the four distinctive types made by the Tower-Binford Elec. & Mfg. Co.



Acorn.

For convenience in making comparisons the cuts show only double pole unfused switches but the four types are made in every possible combination as to the number of poles, fusing, voltage, etc.

The "Mascot" switches are made in capacities from 15 Amp. to 150 Amp. inclusive.
The "Acorn" switches from 25 Amp. to 500 Amp. inclusive.

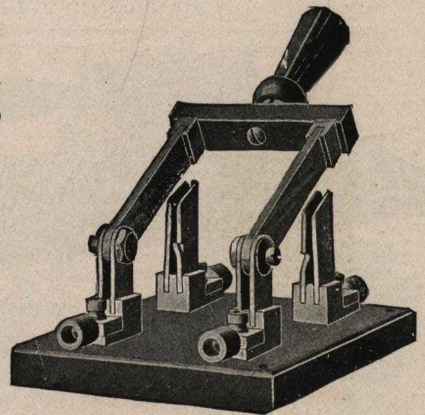


Standard.

The "Standard" and "Imperial" switches from 35 Amp. to 1000 Amp. inclusive.

The relative costs of these switches are in the order named, the "Mascot" being the cheapest. Approved Sept. 18, '07.

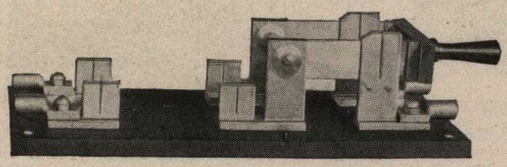
For further information, prices, discounts, etc., address the



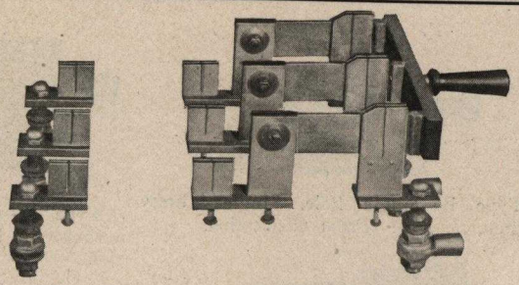
Imperial.

TOWER-BINFORD ELEC. & MFG. CO., Richmond, Va.

SWITCHES, KNIFE—(Continued.)



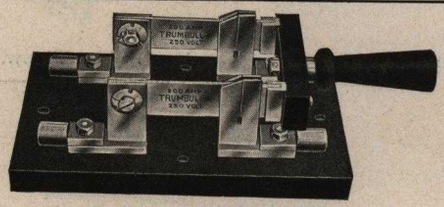
Styles "A," "G" and "Paragon," Front Connected, 250 and 600 Volts.



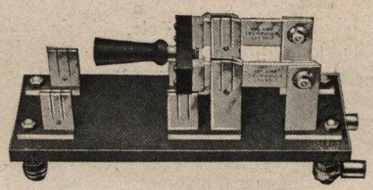
Styles "A," "G" and "Paragon," Back Connected, 250-600 Volts.

Approved May 8, '05.

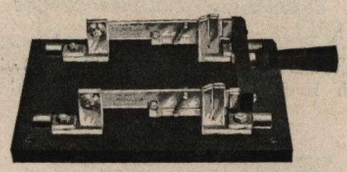
THE J. LANG ELECTRIC CO., Chicago, Ill.



Type "A," without Fuses, front connected.

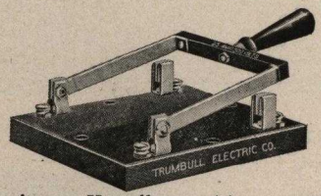


Type "A" for N. E. Code Fuses; handle end with high fingers; also hinge end with high fingers.

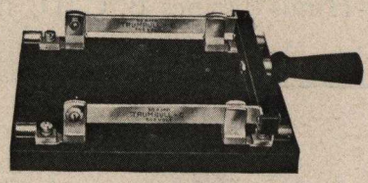


Type "A" with Quick Break Attachment.

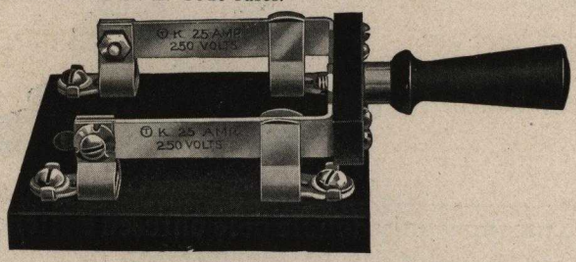
Type "A," 25, 50, 75 and 100 A, 500 V., all capacities, 250 V. One, two, three and four pole, single and double throw, front and back connected. With and without extensions for N. E. Code cartridge enclosed fuses. Made of pure hard drawn copper, with cast copper terminal lugs. Plain or polished finish as desired.



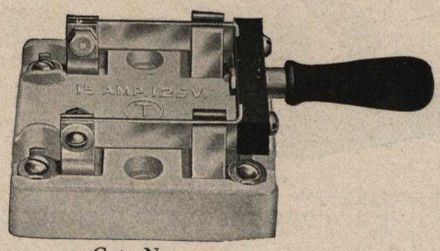
Type "B," 25 A, 500 V.; all capacities, 250 V. One, two and three pole, single and double throw, with or without extensions for N. E. Code fuses.



Type "C," 15 to 100 A., 250 and 500 V. Front connection only; one, two and three pole, single or double throw, with or without N. E. Code fuse connections.



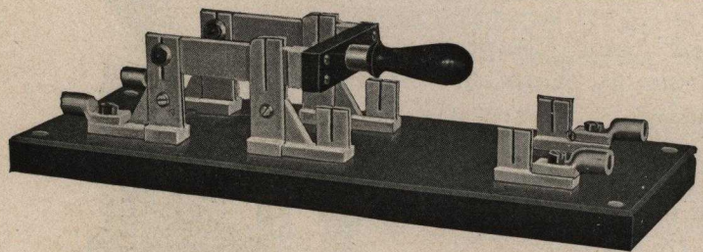
Type "K," 25 A., 250 V. One, two and three pole, front connected, single throw, with and without extensions for standard cartridge fuses.



Cat. No. 955.

Porcelain base switches. Cat. No. 954, double pole, 15 A., 125 V.; No. 955, double pole, 15 A., 250 V.; No. 956, three pole, 15 A., 125-250 V.

TRUMBULL ELECTRIC MFG. CO., Plainville, Conn.

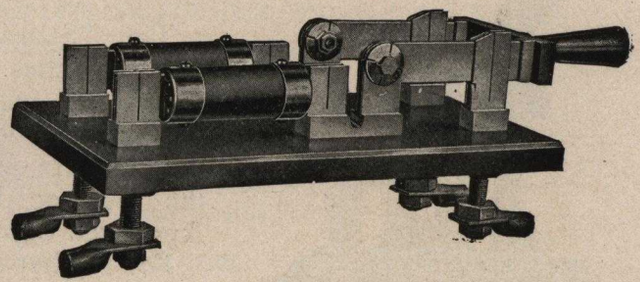


Anderson, types A & B, all capacities, 250 V., Approved April 7, '06.

Also single pole, quick break, 15, 25 and 50 A, 500 V. U-shaped blade connecting single pair of clips; fibre barrier between clips; standard cartridge fuse mounted on same base with switch.

Approved Aug. 20, '06.

A. & J. M. ANDERSON MFG. CO., Boston, Mass.

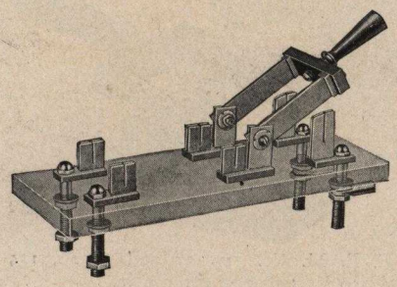


Bernard, all capacities, 250 V. Approved Nov. 25, '04.

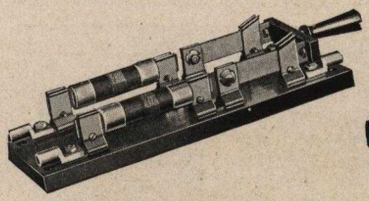
Front or back connected, plain or polished finish, single and double throw. Made also for mounting on rear of switchboard.

E. G. BERNARD CO., Troy, N. Y.

SWITCHES, KNIFE—(Continued.)



Type. A. Two Pole, Back Connected.

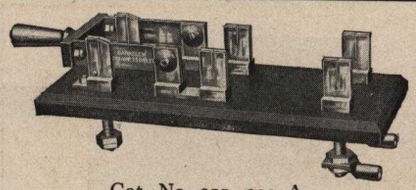


Type B. Front Connected.

"American." Types A and B, 125, 250 and 600 V. All capacities, with or without extensions for cartridge fuses.

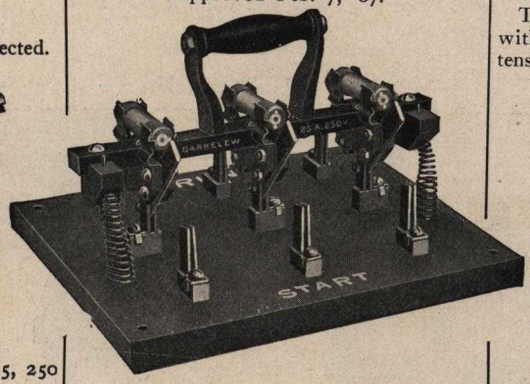
Approved May 7, '08.

AMERICAN ELECTRIC SWITCH CO.,
Springfield, Mass.



Cat. No. 211, 200 A.

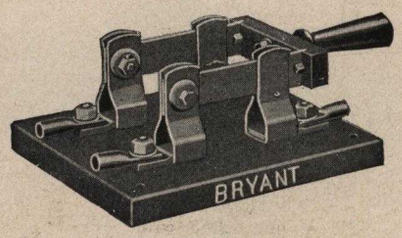
"Premo." All capacities, 250 V., 25, 50, 75 and 100 A., 500 V., with or without standard cartridge fuse extensions.
Approved Feb. 7, '07.



"Barkelew," Motor starting switches for use with A. C. motors, 2 or 3 phase up to 5 H. P. A spring controlled double throw knife switch equipped with cutouts for N. E. Code cartridge enclosed fuses. Fuses are in circuit only when switch is in running position.

Approved Sept. 11, '08.

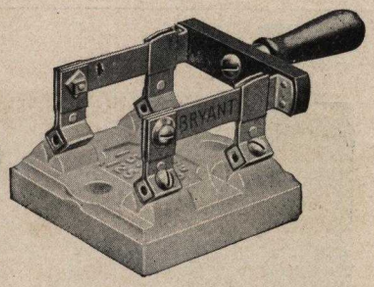
BARKELEW ELEC. MFG. CO.,
Middletown, O.



Cat. No. 1794.

Type F, all capacities, 250 V., with and without 1905 standard enclosed fuse extensions.

Approved Nov. 6, '05.

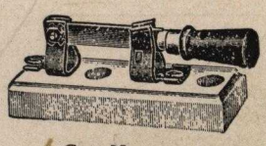


Cat. No. 1438, 15 A.

Type V, baby knife, all styles, 15 and 25 A., 125 and 250 V.

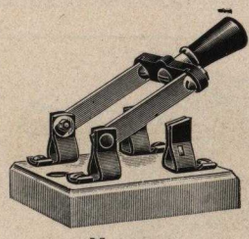
Approved Sept. 7, '05.

BRYANT ELECTRIC CO.,
Bridgeport, Conn.

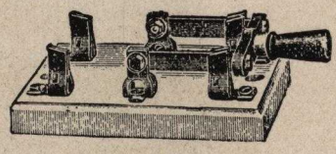


Cat. No. 11734

Cat. No. 11736



No. 11738.



No. 11740.

Mesco. Baby knife switches, 25 A., 250 V., 15 A., 125 V.

125 VOLT, SINGLE POLE.

List No.		Std. Pkg.	Price
7097	15 Amp. S. P. S. T.	100	$0.34
7098	25 Amp. S. P. S. T.	100	.44
7099	15 Amp. S. P. D. T.	100	.60
7100	25 Amp. S. P. D. T.	100	.74

125 VOLT, DOUBLE POLE.

7101	15 Amp. D. P. S. T.	250	$0.42
7102	25 Amp. D. P. S. T.	250	.50
7103	15 Amp. D. P. D. T.	100	.74
7104	25 Amp. D. P. D. T.	100	.90

250 VOLT, SINGLE POLE.

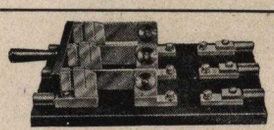
List No.		Std. Pkg.	Price
11734	15 Amp. S. P. S. T.	100	$0.40
11735	25 Amp. S. P. S. T.	100	.50
11736	15 Amp. S. P. D. T.	100	.68
11737	25 Amp. S. P. D. T.	100	.84

250 VOLT, DOUBLE POLE.

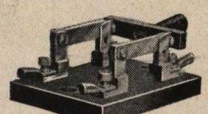
11738	15 Amp. D. P. S. T.	250	$0.50
11739	25 Amp. D. P. S. T.	250	.60
11740	15 Amp. D. P. D. T.	100	.86
11741	25 Amp. D. P. D. T.	100	1.04

Approved April 19, '06.

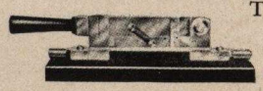
MANHATTAN ELEC. SUPPLY CO., New York, N. Y.



Type "A," all capacities, 250 and 600 V.



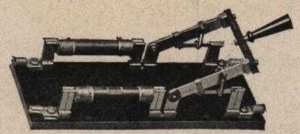
Type "B," 25 to 200 A, 250 V.

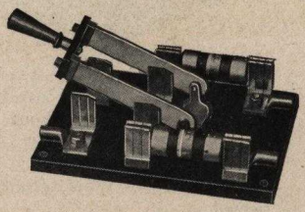


Type "C," quick break, all capacities, 600 V.

Approved March 22, '05.

CLEVELAND SWITCHBOARD CO.,
Cleveland, Ohio.

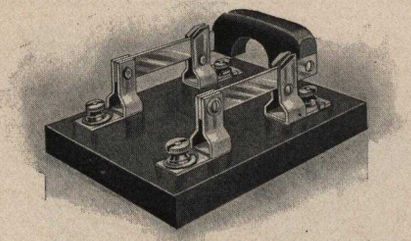




Hill, types, A, B, E and R, all capacities 250 V. Approved Nov. 25,'04. Type C, all capacities, 500 V. Approved Jan. 3, '06.

W. S. HILL ELECTRIC CO., New Bedford, Mass.

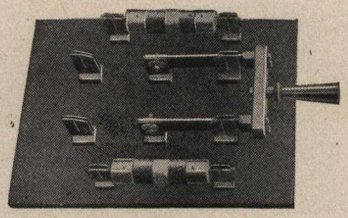
SWITCHES, KNIFE—(Continued.)



Cuthbert Panelboard Switches, 15 A., 125 V., and 25 A., 250 V.

Approved March 20, '08.

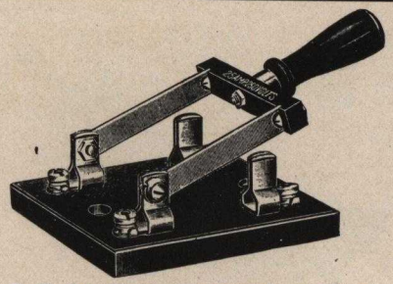
CUTHBERT ELEC. MFG. CO., Chicago, Ill.



Helios, type H-U, all capacities, 250 V. Front and back connected, single, double and three pole, with and without fuse extensions.

Approved June 29, '06.

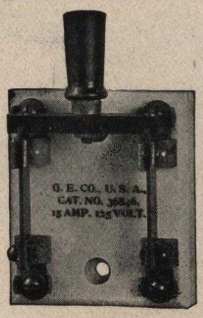
HELIOS MFG. CO., Philadelphia, Pa.



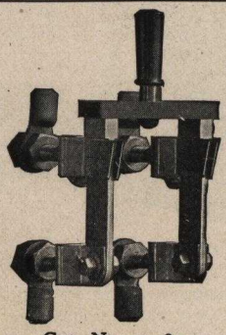
C. E. M. Co. 15, 25 and 35 A., 125 and 250 V., two and three pole.

Approved Dec. 10, '06.

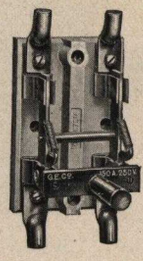
CONN. ELEC. MFG. CO., Bantam, Conn.



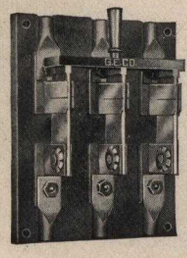
Cat. No. 36846.



Cat. No. 57783.



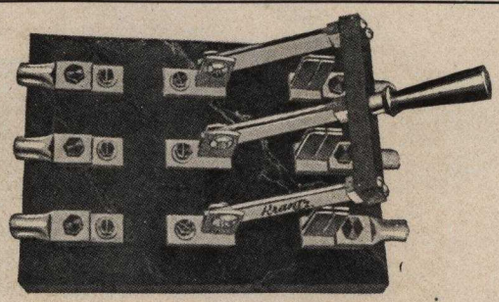
Cat. No. 57514.



Cat. No. 41674.

G. E. double pole, front connected, 25 A., 125 V., Cat. No. 70127. Approved Nov. 21, '04. Also double pole front connected switches, 15 A.; Cat. No. 36846, porcelain base, 125 V.; 42503, slate base, 250 V. Approved Nov. 7, '07. Punched Clip spring types, all styles without fuses, 75-150 A., 250 V.; 30-75 A., 500 V.; also back connected patterns with extensions for open link fuse cutouts, 250 V. Punched clip lever types, Cat. No. 57783, all styles without fuses, 25 to 300 A., also front connected 300 A., and all back connected patterns with extensions for open link fuse cutouts, 250 V. Approved Oct. 18, '07. Type L, Form D-12, Cat. No. 41674, all capacities 250 V. D. C., including types equipped with extensions for link or N. E. Code standard enclosed cartridge fuses. Approved July 27, '07. Type Q, Form C-2, single, double and triple pole, quick break, 60 and 100 A, 600 V. with and without extensions for enclosed cartridge fuses. Approved Apr. 25, '08.

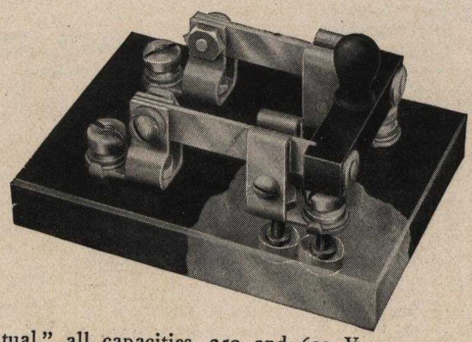
GENERAL ELECTRIC CO., Schenectady, N. Y.



"Krantz," all capacities, 125 and 250 V., with or without open link fuse extensions, front or back connected.

Approved Apr. 9, '07.

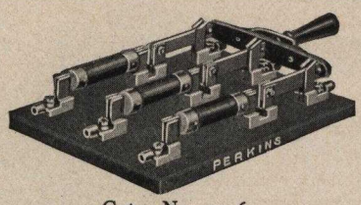
H. KRANTZ MFG. CO., Brooklyn, N. Y.



"Mutual," all capacities, 250 and 600 V.

Approved March 16, '05.

MUTUAL ELEC. & MACHINE CO., Wheeling, W. Va.



Cat. No. 3246.

Perkins switches all capacities, 250 and 600 V., with and without extensions for open link or National Elec. Code Standard cartridge enclosed fuses; single, double and three pole types, front or back connected.

Approved March 21, '08.

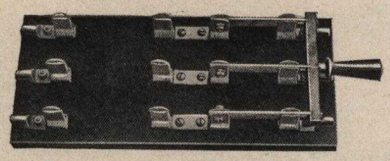
PERKINS ELEC. SWITCH MFG. CO., Bridgeport, Conn.

"Perfection," quick break, single pole knife switch, 25 A. 550 V.

Approved June 9, '08.

(Cut not available)

PERFECTION SUPPLY CO., New York, N. Y.



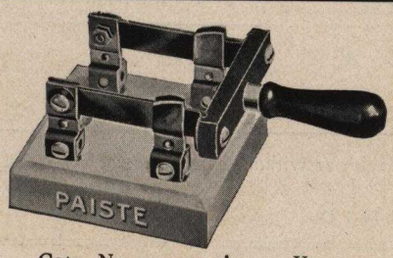
"Trio," 25 to 300 A., 250 V.; 25, 50, 75 and 100 A, 600 V., with and without extensions for standard enclosed fuses. Front and back connected, one, two, three and four pole.

Also 15 A. 125 and 250 V., single and double throw, one, two and three pole.

Approved Nov. 23, '07.

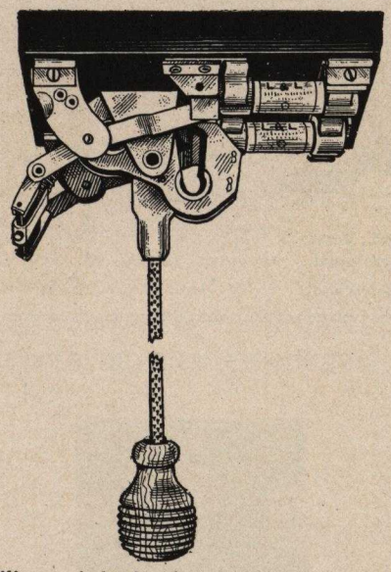
TRIO MFG. CO., Rock Island, Ill.

SWITCHES, KNIFE—(Continued.)



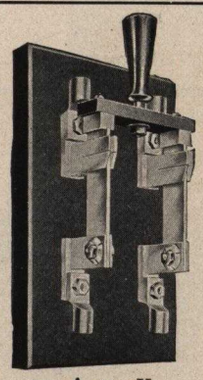
Cat. No. 517, 15 A, 250 V.
Porcelain base baby knife switches, 15 and 25 A., 125 and 250 V. Cat. Nos. 501 to 510 inclusive and 513 to 522 inclusive. Approved March 10, '08.

H. T. PAISTE CO., Philadelphia, Pa.

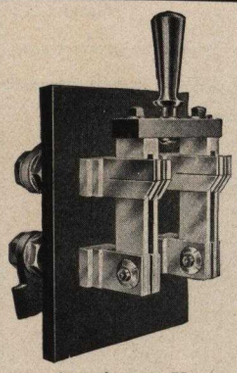


L & L ceiling switch, double pole, front connected.
Approved Dec. 12, '04.

CHAS. W. LEVERIDGE, New York, N. Y.



100 A, 250 V.
Double pole, single throw.



800 A, 250 V.
Two pole single throw.

"Western Electric." All capacities, 125, 250 and 600 V.
Approved Feb. 27, '05.

WESTERN ELECTRIC CO., Chicago, Ill.

"Crescent." All capacities, 250 V., 2 and 3 wire, double and three pole, front and back connected. Approved Oct. 29, 1906.

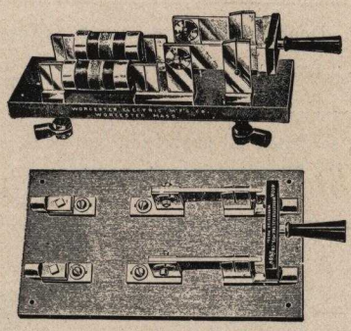
(Cuts not available).

CRESCENT ELECTRIC MFG. CO., Rochester, N. Y.

"Davis." Type B, all capacities, 250 V. Approved July 11, '07.

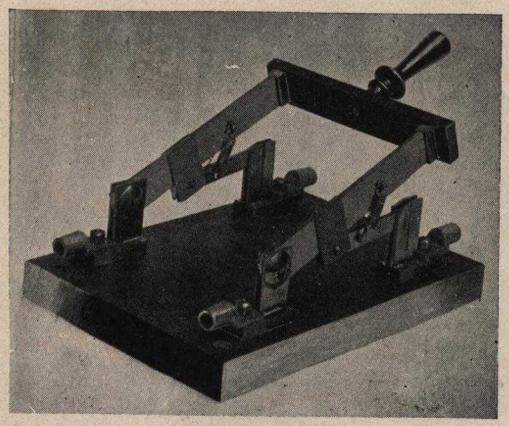
(Cuts not available).

MENOMINEE ELECTRIC MFG. CO., Menominee, Mich.



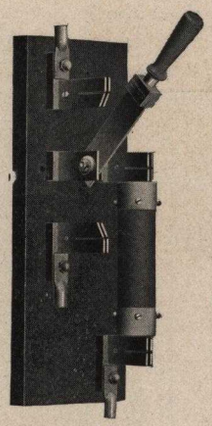
"Worcester." All capacities, 250 V.
Approved Dec. 21, '04.

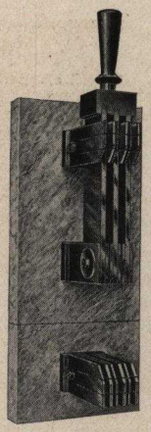
WORCESTER ELEC. MFG. CO., Worcester, Mass.



"Wurdack," all capacities, 250 and 500 V.
Approved Apr. 14, '05.

WURDACK ELEC. MFG. CO., St. Louis, Mo.





"Westinghouse," all capacities, 250 and 600 V.
Approved Oct. 30, '05.

WESTINGHOUSE ELEC. & MFG. CO., Pittsburg, Pa.

"Cornell Switches," 0-100 A., 250 and 600 V., Front or back connected, with or without extensions for N. E. Code cartridge enclosed fuses, two and three pole.
Approved March 10, 1908.
(Cuts not available.)

ELECTRIC FITTINGS CO., Trumansburg, N. Y.

"Metropolitan." 125, 250 and 500 V. All capacities.
Approved June 18, '07.

(Cuts not available).

METROPOLITAN SWITCHBOARD CO., New York, N. Y.

SWITCHES, KNIFE—(Continued), SWITCHES, HIGH POTENTIAL, OIL BREAK, SERIES ARC and AUTOMATIC.

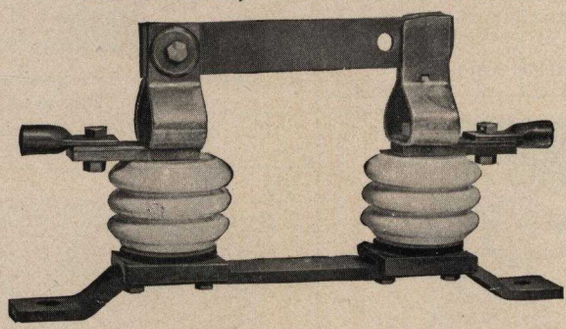
"Globe." Double pole, 25 A., 250 V. Approved June 8, '05.
(Cuts not available).

WM. T. PRINGLE, Philadelphia, Pa.

Type A, switches, all capacities, 250 volts, single, double and three pole, with or without extensions for open link fuses. Approved May 18, '08. (Cuts not available).

WALKER ELECTRIC CO., Philadelphia, Pa.

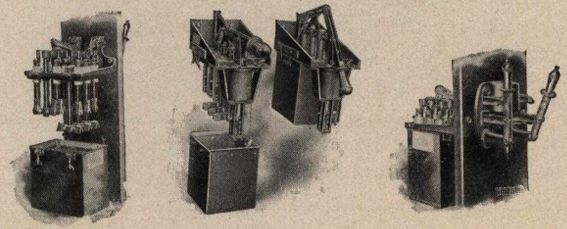
SWITCHES, HIGH POTENTIAL.



"Bullock" Type A, 100, 200 and 300 A., 3300 and 6600 V. Type B, 100 A., 20000 V. Approved for disconnecting service only, and not for operation at ratings assigned. Approved July 5, '06.

ALLIS-CHALMERS CO., Milwaukee, Wis.

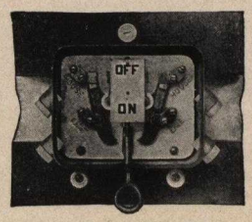
SWITCHES, OIL BREAK.



G. E. for 1000, 2500, 6000, 6 600 and 15000 V., 50-200 A. Approved Nov. 28, '04.

GENERAL ELECTRIC CO., Schenectady, N. Y.

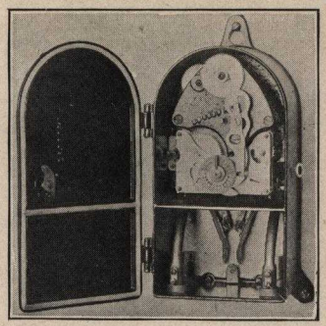
SWITCHES, SERIES ARC.



Wood. Approved Dec. 14, '04.

FORT WAYNE ELEC. WORKS, Fort Wayne, Ind.

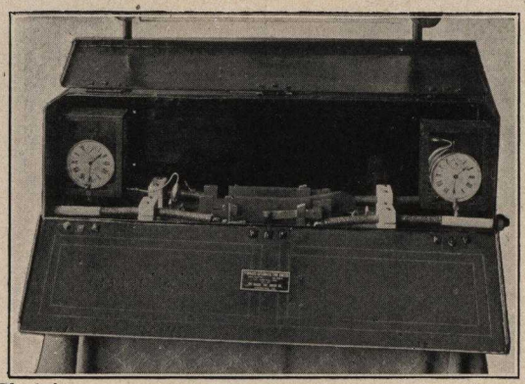
SWITCHES—AUTOMATIC.



G. E. Type T, 25 A., 250 V. Clock mechanism enclosed in iron case. Approved July 31, '06.

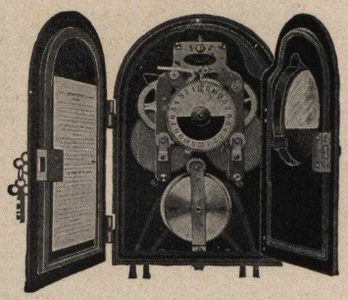
Also self contained and counterweighted float switches for control of solenoid circuits in automatic motor starters; single pole, 15, 10 and 5 A.; double pole, 25, 15 and 10 A., 500, 250 and 125 V. respectively. Double pole also for direct motor control with motors of the smaller sizes. Approved June 8, '08.

GENERAL ELECTRIC CO.,
Schenectady, N. Y.



"Brauer" 50 A., 250 V. A double pole knife switch mounted in a heavy iron case. The operation of the switch governed by a double spring and alarm clock attachment. Approved June 22, '08.

R. B. BRAUER,
209 W. Broad St., Richmond, Va.



Hartford Type B, Double Pole, 20 A., 250 V.

Approved July 2, '07.

HARTFORD TIME SWITCH CO.,
A. Hall Berry, Sole Agent,
101 Warren St., New York, N. Y.

P-M Remote Control Switches.

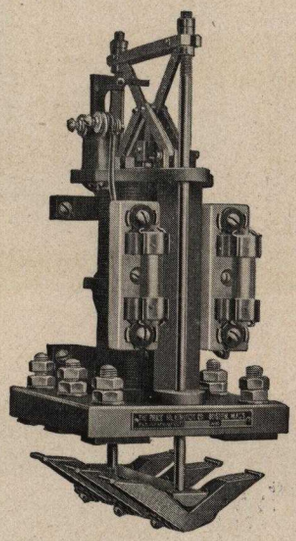
For Economy, Convenience and Safety on Light and Power Circuits.

0-200 A., 250 V., d. c., 440 V., a. c., one, two or three pole toggle mechanism operating laminated copper switch blades by means of control circuits energizing magnets, with or without special iron box. Control circuit to be used throughout as for low potential systems.

The P-M Remote Control Switch System allows of complete control of lights and motors at distant points in the building without bringing the service wires to these points.

It simplifies the control of circuits and guards against waste of current and electrical fires.

Allows all units or any group of units to be cut off by the pressing of a button at any desired point in the building.



The P-M Remote Control Switch System enables the engineer to place his wire-ways from service entrance to distributing panels without regarding switch outlets.

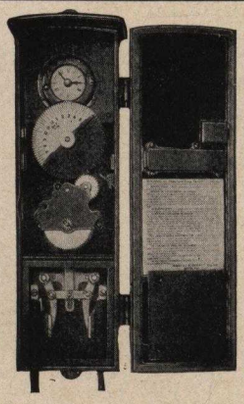
It saves money in wiring a building; there is less conduit and wire needed.

A book fully describing and illustrating the P-M Remote Control Switch System can be had on request.

For Direct or Alternating Currents

Approved April 29, '07.

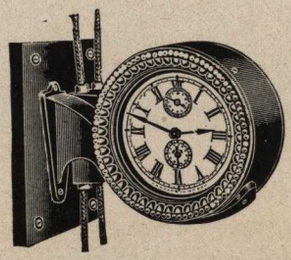
PETTINGELL-ANDREWS COMPANY, Boston, Mass.



Anderson special clock and mechanism in water-tight iron box, 2 and 3 pole, 15, 25, 50, 100 and 200 A., 250 V.

Approved Oct. 14, '07.

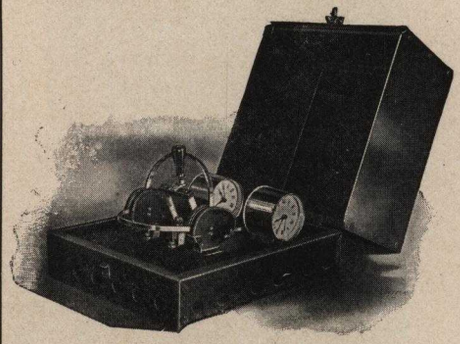
A. & J. M. ANDERSON MFG. CO., Boston, Mass.



"Mesco" Time Switch. A clock operating, by means of a cam, an approved push button snap switch which is enclosed in iron. Clock exposed so as to act as time piece.

Approved Nov. 16, '06.

MANHATTAN ELECTRICAL SUPPLY CO., New York, N. Y.



Crescent, types "A" and "B," 25, 50 and 75 A., 250 V. Clock controlled spring mechanism, operating approved knife switch; with iron box enclosing entire device.

Approved Oct. 9, '06.

CRESCENT COMPANY, Valparaiso, Ind.

Automatic electric, double acting time switch, 50 A, 250 V. Standard knife switch automatically opened and closed by falling weights.

Approved June 28, '06.

(Cut not available.)

AUTOMATIC TIME SWITCH CO., Derby, Conn.

Chappel Time Switch. An approved double pole surface snap or knife switch. Operation of controlling mechanism governed by a clock movement on the same base and enclosed in a tight metal case, 20, 50, 75 and 100 A, 250 V.

Approved April 20, '08.

CLEVELAND DENTAL MFG. CO., Cleveland, O.

"Perfect" Time Switch, cast iron case enclosing special clock and spring motor for actuating an approved knife switch, 2 or 3 pole, 30 A, 250 V.

Approved Sept. 18, '07.

(Cut not available.)

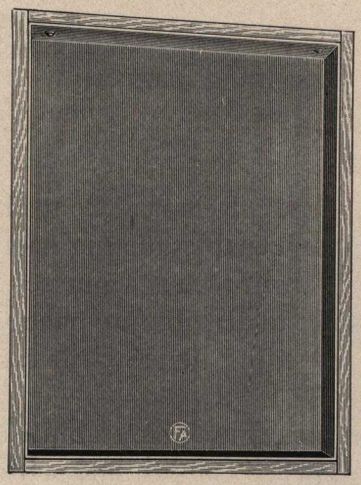
CLARK & HARVEY, Dayton, Ohio.

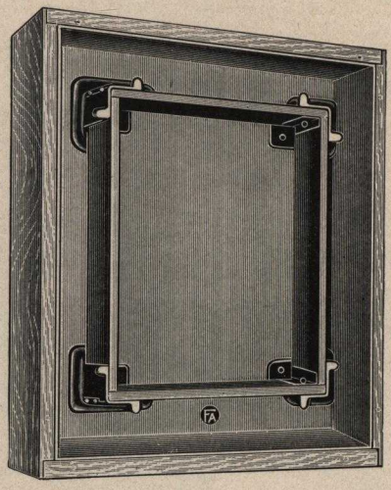
Relay No. 171-A. Magnet energized by 24 volt current controlled from telephone switchboard. Double break contacts to be connected in series with one 16 c. p. 110 V, lamp used for lighting telephone booths. Relay and terminals mounted on a slate base and enclosed in a steel or asbestos lined wood box.

Approved June 17, '08.

WESTERN ELECTRIC CO., New York, N. Y.

"F A" Cabinets





Wood Boxes Lined.

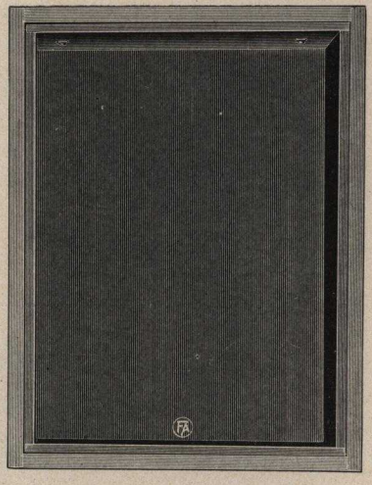
Type 130 Steel lined no gutter.

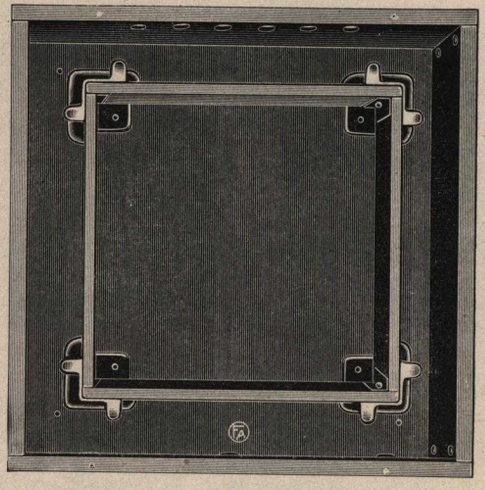
Type 150 Asbestos lined no gutter.

Type 136 Steel lined with gutter.

Type 156 Asbestos lined with gutter.

Wood boxes with either steel or asbestos lining. With or without gutter or wiring compartment.



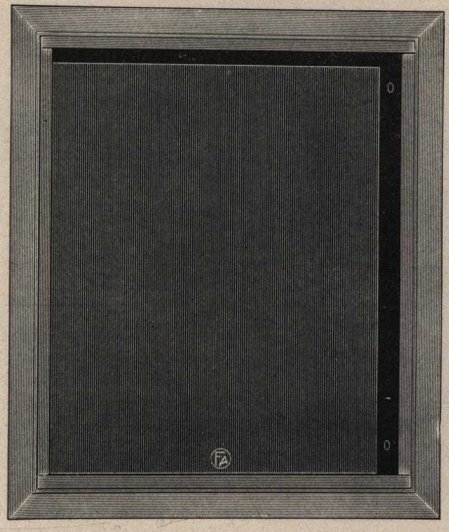


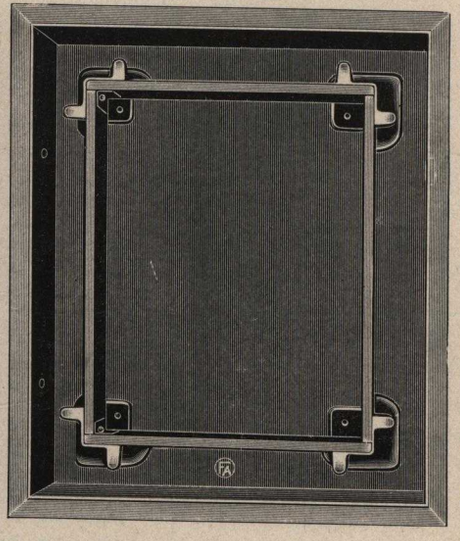
Steel Boxes. Formed Up.

Type 230 slate lined no gutter.

Type 236 slate frame forming gutter.

Sheet steel boxes formed from one piece of steet steel with riveted corners, with ½" black slate lining for no gutter box and ½" slate frame with adjustable corner castings for gutter boxes.





Steel Boxes. Built Up.

Type 330 slate lined no gutter.

Type 336 slate frame forming gutter.

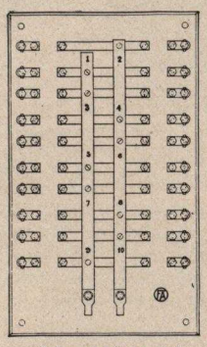
Built up with sheet steel with reinforced corners back and front with angle irons all securely riveted together with ½" black slate lining for no gutter box and ½" slate frame with adjustable corner castings for gutter boxes.

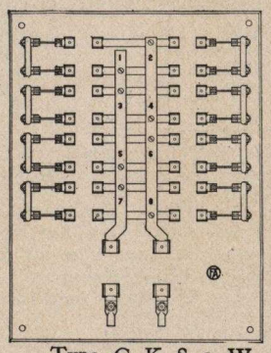
Approved Nov. 6, 1907.

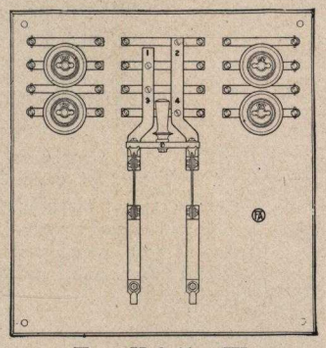
FRANK ADAM ELECTRIC CO., St. Louis, Mo.

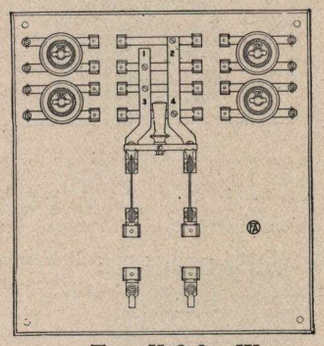
Standard "F A" Panel Boards

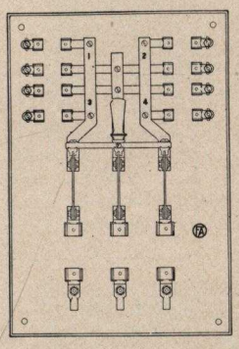
Made for voltages of 125, 125-250, and 250 volts. 2 and 3 wire, without branch switches and with either knife or snap switches on branches, and cable terminals, fuses, or knife switch on bus bar. With fuse terminals for open link, Edison plug, or New Code Cartridge enclosed fuses. The Standard Panels as per catalog, or special panels on specifications. Also panels with branches convertible from 125 to 250 V. and metering panels.

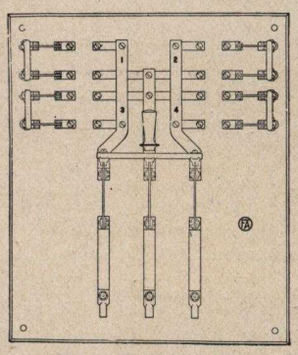

Type H 2 W

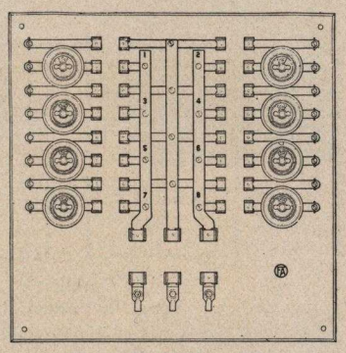

Type G K S 2 W

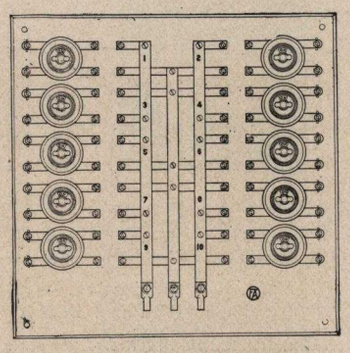

Type H S ½ 2 W

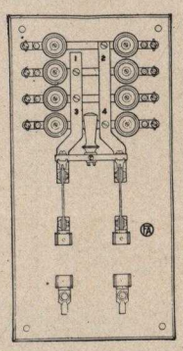

Type H S S 2 W

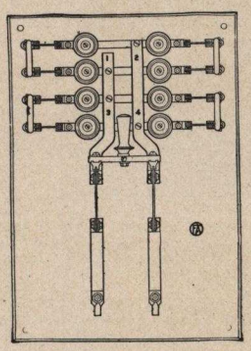

Type H 3 W

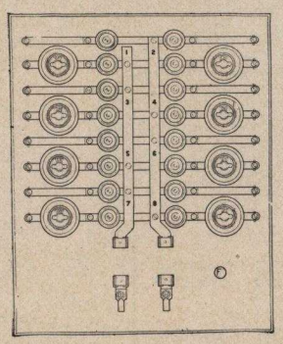

Type G K S 3 W

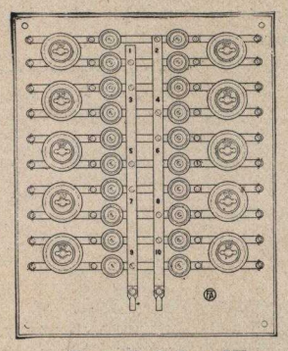

Type H S ½ 3 W

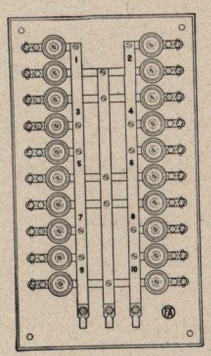

Type H S S 3 W

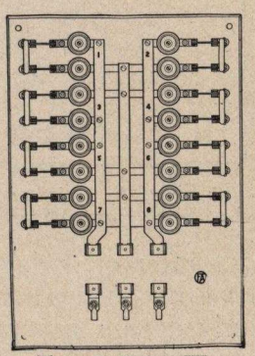

Type P 2 W

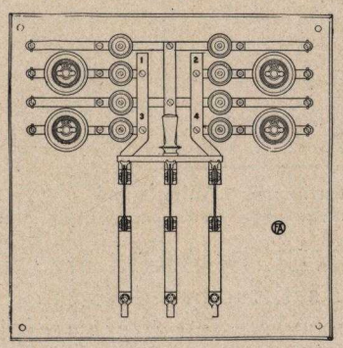

Type P K S 2 W

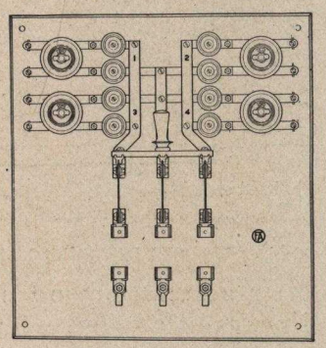

Type P S ½ 2 W


Type P S S 2 W


Type P 3 W


Type P K S 3 W

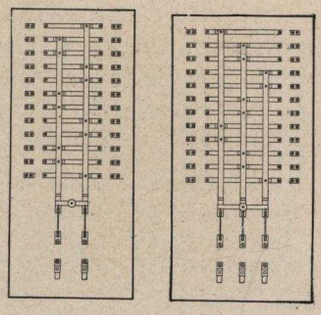

Type P S ½ 3 W


Type P S S 3 W

Approved Mar. 31, 1908.

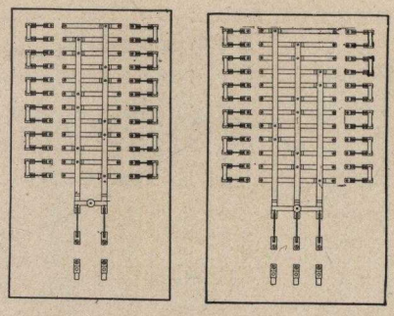
FRANK ADAM ELECTRIC CO., St. Louis, Mo.

Cuthbert's Panel Boards



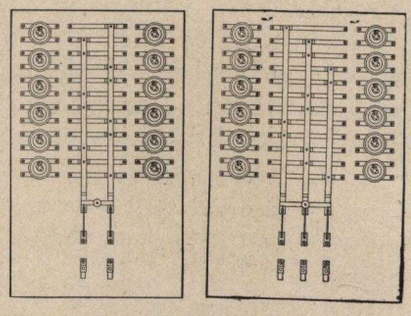
Cuthbert's
Type "A" Panel Boards

Constructed of black enamel slate; highly polished copper; open link or new code fuses; 125 or 250 volts.



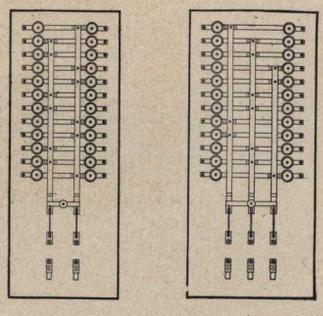
Cuthbert's
Type "B" Panel Boards

Constructed of black enamel slate; highly polished copper; open link or new code fuses; 15 amp. panel switches on 125 volt board; 25 amp. panel switches on 250 volt board.



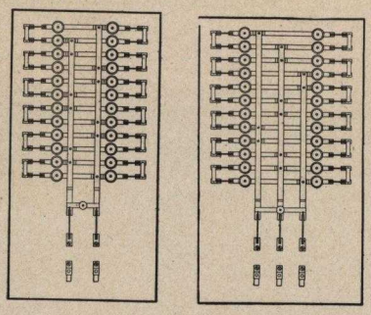
Cuthbert's
Type "C" Panel Boards

Constructed of black enamel slate; highly polished copper; 10 ampere. Hart snap switches so arranged that they can be replaced in a few minutes; open link or new code fuses; 125 or 250 volts.



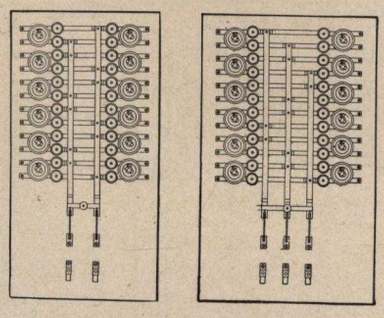
Cuthbert's
Tvpe "D" Panel Boards

Constructed of black enamel slate; highly polished copper Edison plug fuses for 125 volts; renewable plug fuse cases for 250 volts.



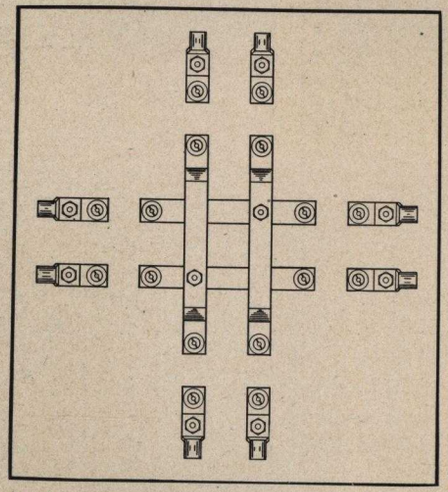
Cuthbert's
Type "E" Panel Boards

Constructed of black enamel slate; highly polished copper, 15 amp. panel switches on 125 volts; 25 amp. switches on 250 volts; Edison plug fuses for 125 volts; renewable plug fuse cases for 250 volts.

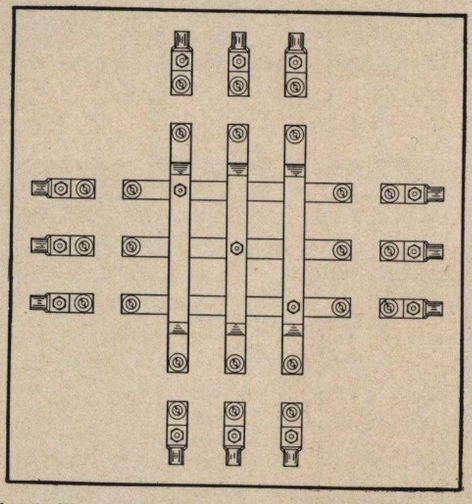


Cuthbert's
Type "F" Panel Boards

Constructed of black enamel slate; 10 ampere Hart snap switches so arranged that they can be replaced in a few minutes; Edison plug fuses for 125 volts; renewable plug fuse cases for 250 volts.



Cuthbert's Type "N" Centers of Distribution, 2 Wire, 2 and 3 Branches, Black Enameled Slate, metal parts all copper.

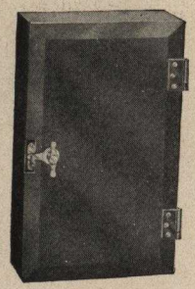


Cuthbert's Type "P" Centers of Distribution, 3 Wire, 2 and 3 Branches, Black Enameled Slate, metal parts all copper.

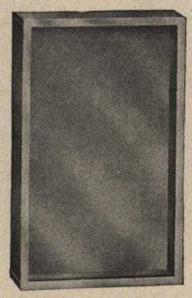
CUTHBERT'S PANEL BOARDS are compact and well finished, possess the highest grade, latest and most satisfactory devices of their kind on the market. The standard line, as listed above, has been selected after careful study of the general requirements, but other Panels to meet special conditions can be made to order. The maker's modern facilities for manufacturing, and his thorough knowledge and practical experience assures the buyer that his product is as good as can be produced. Write for catalogue No. 29.

CUTHBERT ELECTRICAL MFG. CO., 105-109 So. Clinton St., Chicago.

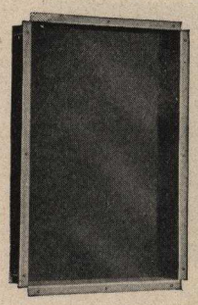
Cuthbert's Cabinets



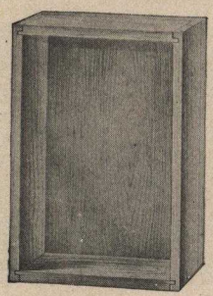
Cuthbert's Type "B" Wall Mounting Steel Box for panels, switches and cutouts.



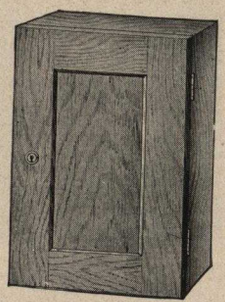
Cuthbert's Type "C" Wall Mounting Steel Box for panels, switches and cutouts, with mats and doors of steel or wood. Types "A," "B," "C" and "D."



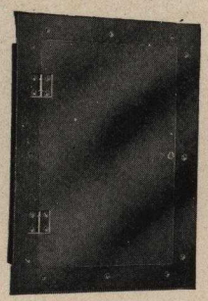
Cuthbert's Type "D" Flush Mounting Steel Box for panels, switches and cutouts, with mats and doors of steel or wood, Types "A," "B," "C" and "D."



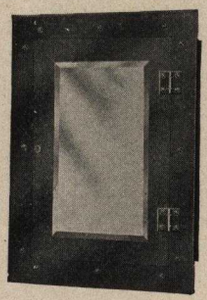
Cuthbert's Type "C" Flush Mounting Wood Box for panels, switches and cutouts, steel, slate or asbestos lined, with mats and doors of steel or wood.



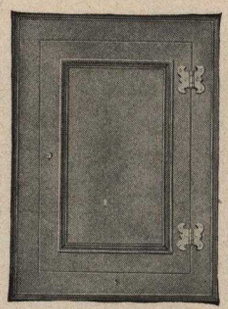
Cuthbert's Type "B" Wall Mounting Wood Box for panels, switches, and cutouts, steel, slate or asbestos lined.



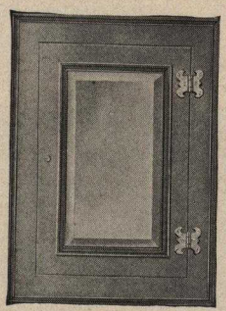
Cuthbert's Type "A" Steel Mat and Door, No. 12 or No. 10 steel, plain finish.



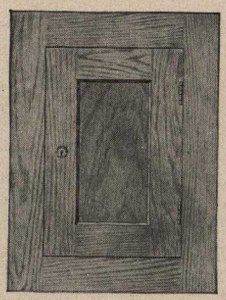
Cuthbert's Type "B" Steel Mat and Door, No. 12 or No. 10 steel, glass panel in door.



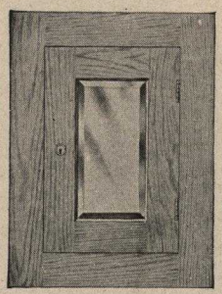
Cuthbert's Type "C" Steel Mat and Door, No. 12 or No. 10 steel, ornamental finish.



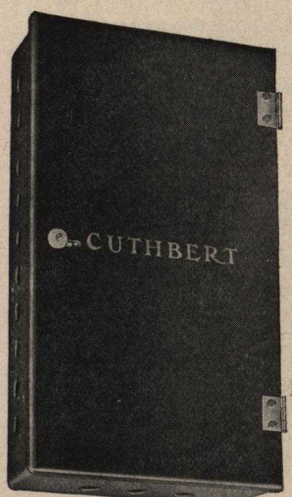
Cuthbert's Type "D" Steel Mat and Door, No. 12 or No. 10 steel, glass panel in door.



Cuthbert's Type "A" Wood Mat and Door.



Cuthbert's Type "B" Wood Mat and Door, glass panel in door.



Cuthbert's Type "A" Standard Steel Cutout and Switch Box.

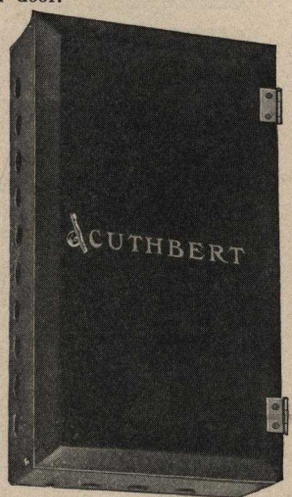
STEEL CABINETS are constructed of the blue annealed steel sheets of No. 14, 12 or 10 standard gauge (see gauge thickness on page 40 of catalogue.)

WOOD CABINETS are constructed of pine or oak and can be lined with slate, steel or asbestos.

STEEL DOORS AND MATS are made in four types. "A," "B," "C" and "D" are for steel cabinets, Types "C" and "D." Types "A" and "B" are adapted for a job where substantial but plain fittings are required. Types "C" and "D" are adapted for a job where substantial and ornamental fittings are required.

WOOD DOORS AND MATS are made of pine or oak and are adapted for steel cabinets Types "C" and "D," wood cabinet Type "C."

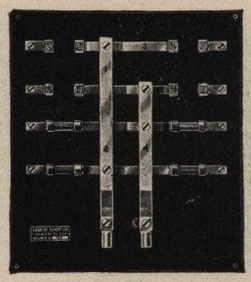
Write for Catalogue No. 29.



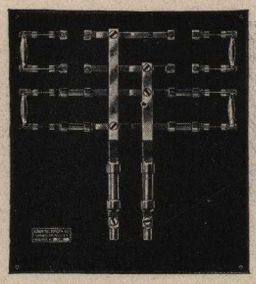
Cuthbert's Type "AA" Standard Steel Cutout and Switch Box.

CUTHBERT ELECTRICAL MFG. CO., 105-109 So. Clinton St., Chicago.

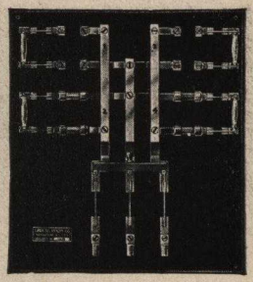
Crouse-Hinds Panel Boards



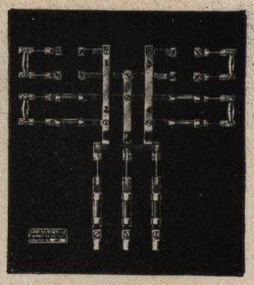
Type "A" 2 to 2 wire panel, branches fused.



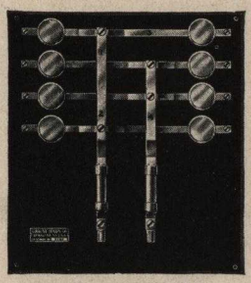
Type "A" 2 to 2 wire panel, mains fused, fuses and switches in branches.



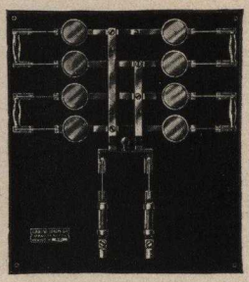
Type "A" 3 to 2 wire panel, switch in mains, fuses and switches in branches.



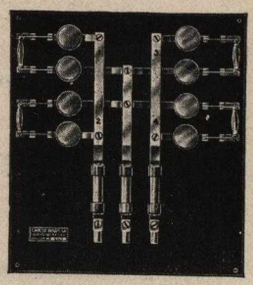
Type "A" 3 to 2 wire panel, fuses and switches in mains and branches.



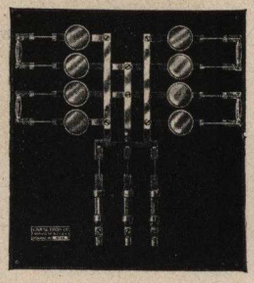
Type "D" 2 to 2 wire panel, mains and branches fused.



Type "D" 2 to 2 wire panel, fuses and switches in mains and branches.



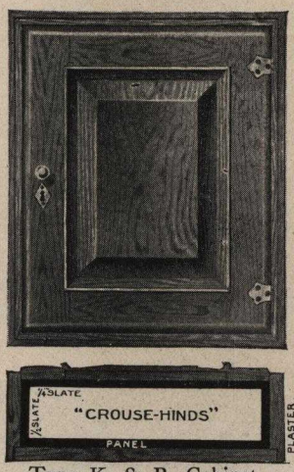
Type "D" 3 to 2 wire panel, mains fused, fuses and switches in branches.



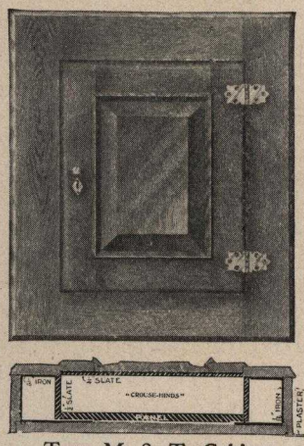
Type "D" 3 to 2 wire panel, fuses and switches in mains and branches.

"Crouse-Hinds" panelboards, for two or three wire, 125, 125-250 and 250 volts, with or without main line knife switches and cutouts. With Edison plug or cartridge enclosed fuse cutouts and knife switches in branch circuits. Approved July 30, 1908.

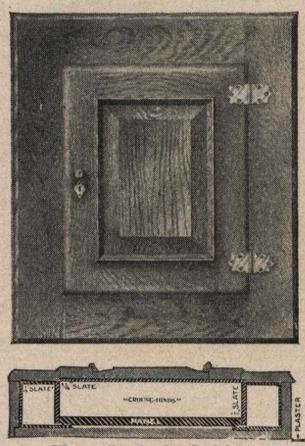
Crouse-Hinds Cabinets



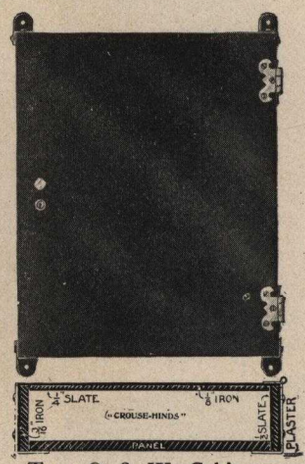
Type K. S. R. Cabinet.



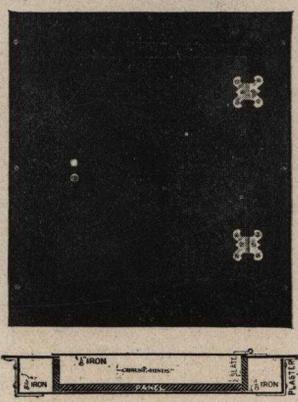
Type M. S. T. Cabinet.



Type L. S. S. Cabinet.



Type O. S. W. Cabinet.

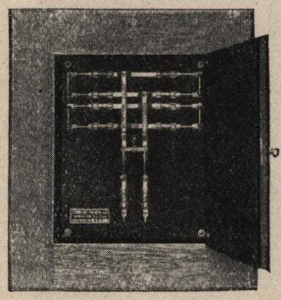


Type P. F. Z. Cabinet.

"Crouse-Hinds" wooden panelboard cabinets, steel or slate lined. Doors with or without glass panel. Steel panelboard cabinets with and without slate gutter, wood or steel trim. Doors with and without glass panel.

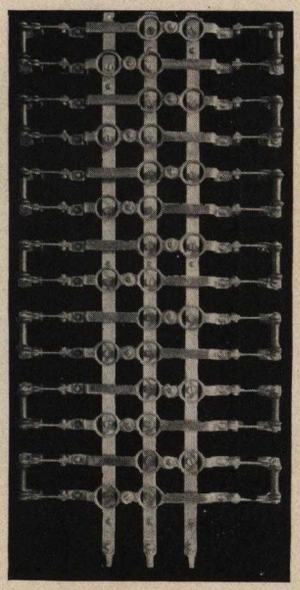
Approved July 21, 1908.

CROUSE-HINDS CO., Syracuse, N. Y.

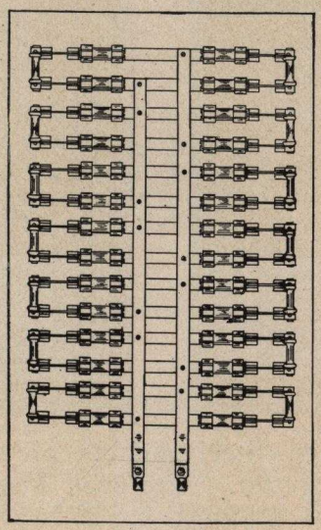


Type A-2 to 2 wire, 4-circuit panel mounted in L. S. S Cabinet.

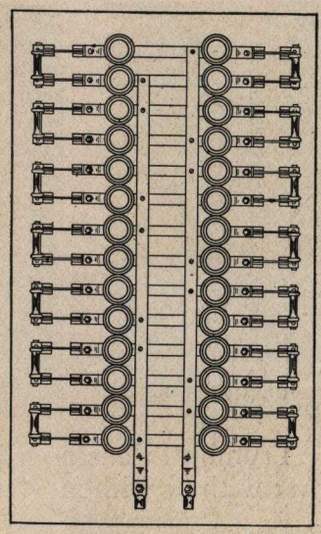
Lang Panel Boards



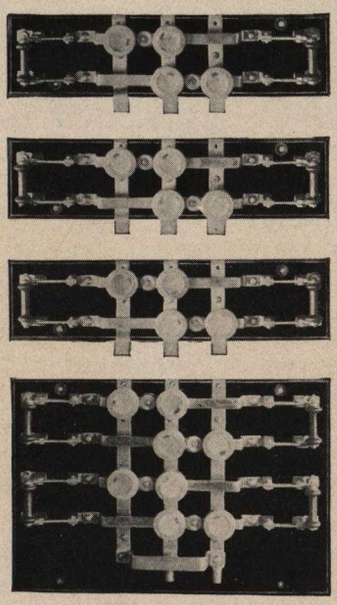
Universal Panel Board for Edison Plug fuses, 3 wire, 250-125 volts, 2 wire, 125 volts.



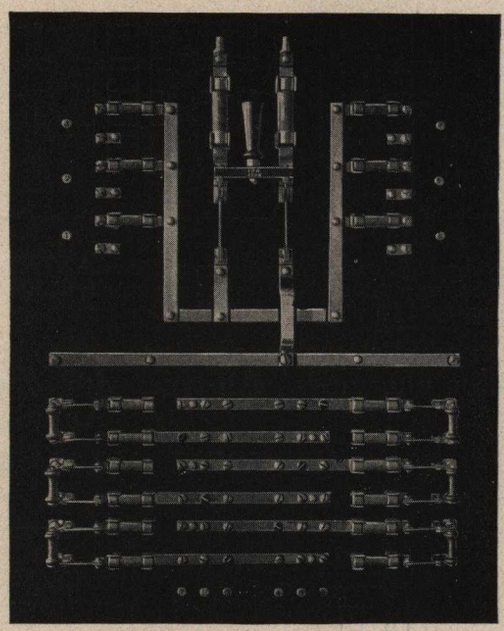
Lang Standard Panel Boards Enclosed fuses, 125 volts, 250 volts.



Lang Standard Panel Boards Edison Plug fuses, 3 wire, 250-125 volts, 2 wire, 125 volts.

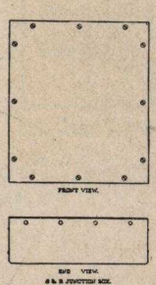


Universal Panel Board units for Edison Plug fuses, 3 wire, 250-125 volts, 2 wire, 125 volts.



Mc Williams Universal Metering Panel Board. 3 wire, 250-125 volts, 2 wire, 125 volts.

THE J. LANG ELECTRIC CO., Chicago, Ill.



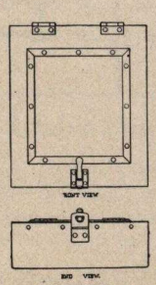
Steel Panelboard Cabinets with or without steel gutters, with or without back wiring compartment. Metal doors, with or without glass panels.

Approved Mar. 20, '08.

Also 125 and 250 V, 2 and 3 wire panelboards equipped with knife switches and terminals for cartridge enclosed fuses.

Approved Feb. 15, '08.

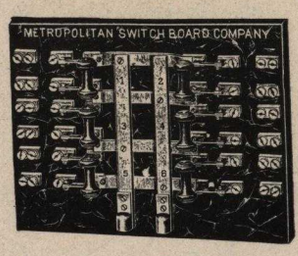
ELECTRIC MFG. CO.,
New Orleans, La.



"Metropolitan Panelboards, 125 and 250 V., all capacities and types. Approved June 18, '07; also steel or wooden cabinets for panelboards or switches, with gutters and linings of slate, marble or steel. Steel or wooden doors and trim.

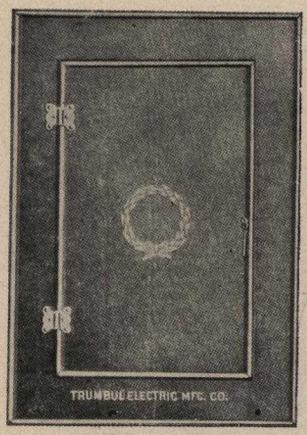
Approved June 8, '07.

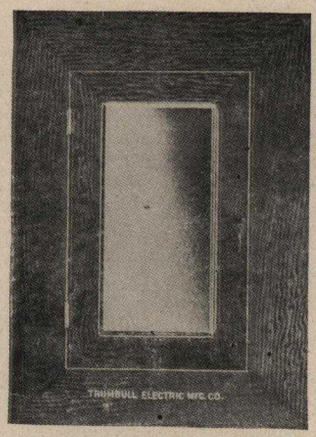
METROPOLITAN SWITCHBOARD CO.,
New York, N. Y.

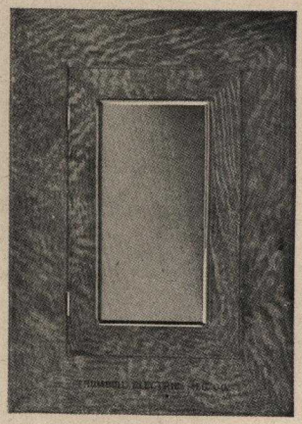


PANELBOARDS AND CABINETS—(Continued).

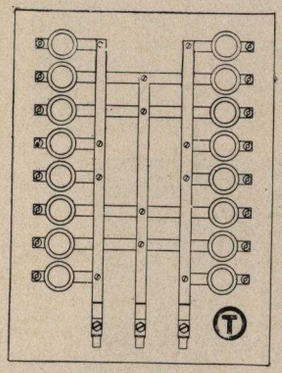
"Trumbull" Cabinets and Panelboards



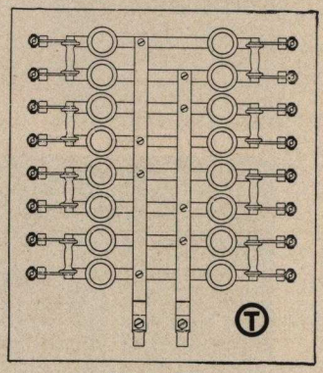




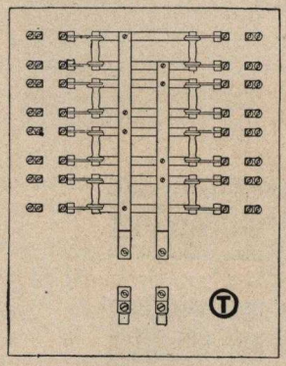
Trumbull Panelboard Cabinets. Steel cabinets, all steel or wood trimmed and glass doors; with or without slate lined gutter. Approved Aug. 21, '06.



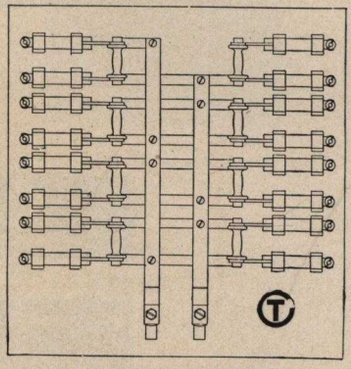
Type "P."
3 to 2 wire with screw shells for Edison plug fuses on branches.



Type "PS."
2 to 2 wire with switches and screw shells for Edison fuses on branches.



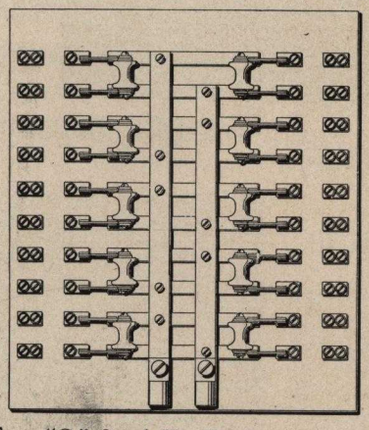
Type "OS."
2 to 2 wire with open link fused switches and mains.



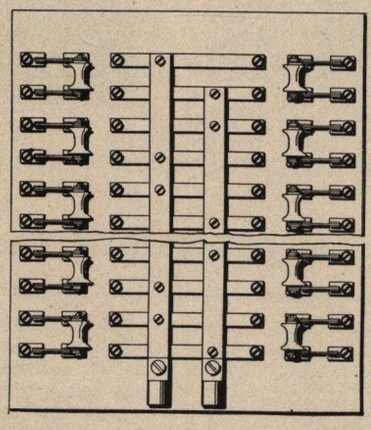
Types "ES."
2 to 2 wire with switches and enclosed fuses on branches.

Trumbull Panelboards, 125 V., two and three wire, and 250 V. two wire; cartridge, link or Edison plug fuses. All types with or without branch circuit switches up to 15 A. Approved Sept. 9, '07.

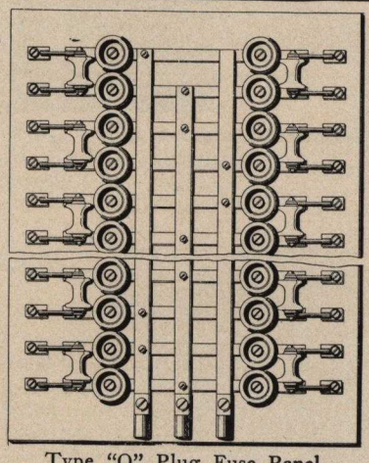
TRUMBULL ELECTRIC MFG. CO., Plainville, Conn.



Type "G," Spool Handle Switch Panel.



Type "F," Spool Handle Switch Panel.



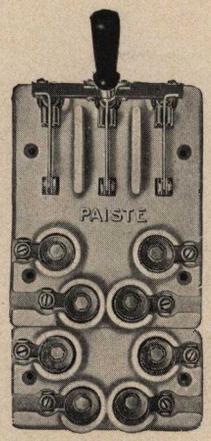
Type "O" Plug Fuse Panel.

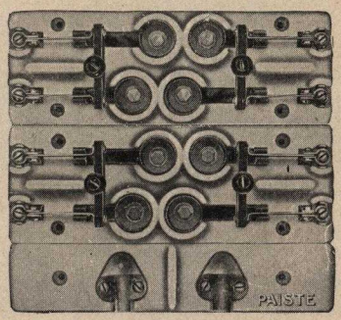
"Krantz" Panelboards. Type A, B, F, G, M, S, R, NC, O, T, and W, and Center of Distribution, 125 and 250 V., open link, cartridge or Edison plug fuses. Approved July 5, '07. Also Jones Universal Metering Panelboard, 2 and 3 wire, 125 and 250 V. Approved for use where installed in approved steel cabinets. Approved July 22, '07.

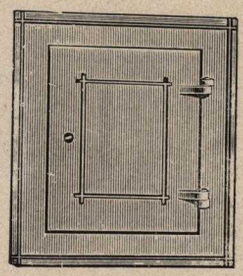
Also "Krantz" panelboard cabinets of wood. metal lined, or of steel with or without lined gutters. Approved June 8, '07.

H. KRANTZ MANUFACTURING CO., Brooklyn, N. Y.

PANELBOARDS AND CABINETS—(Continued).



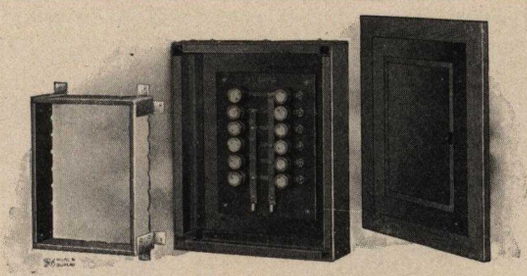




Paiste "Panelettes," 125 and 250 V. Porcelain base units carrying cutouts and knife switches. Each "Panelette" is built up from similar units to the desired size. Type A. Cat. Nos. 5110 to 5115 incl., and 5120 to 5129 incl. Type B, Cat. Nos. 5300 to 5305 incl., and 5315 to 5324 incl. Type C, Cat. Nos. 5130 to 5149 incl. Approved Sept. 5, '08.

Also "Le Manquais," Type A, Cabinets for metal conduit systems. Approved March 5, '07.

H. T. PAISTE CO., Philadelphia, Pa.



G. E. Metal cabinets with wooden doors and trims. Also wooden, asbestos lined. Approved except for use with metal conduit systems. Approved May 16, '07. Also 2 and 3 wire panelboards. Approved Nov. 28, '04.

GENERAL ELECTRIC CO., Schenectady, N. Y.

Cleveland Switchboard Co., two and three wire panelboards, 125, 125-250 and 250 V., with double pole knife switches in branch circuits, with open link, Edison plug or cartridge enclosed fuses. Approved Apr. 25, '08.

Also wood or steel cabinets with or without gutters, lined with slate or steel. For panelboards, switches or cutouts.

Approved May 19, '08.

(Cuts not available)

CLEVELAND SWITCHBOARD CO., Cleveland, Ohio.

Crescent panelboards, 125 V., equipped with 1905 standard type enclosed cartridge fuse cutout.

Approvd Nov. 9, '05.

(Cuts not available)

R. R. ALMSTEAD, Rochester, N. Y.

"E. M. Co," two and three wire panelboards, 125 V., with or without knife switches in branch circuits, with open link or Nat. Elec. Code Standard cartridge enclosed fuses.

Approved Sept. 12, '08.

Also steel panelboard Cabinets with steel trim and door.

Approved Sept. 11, '08.

(Cuts not available)

ELECTRICAL MFG. CO., Cleveland, Ohio.

Leonard-Bundy two and three-wire panelboards for 125-250 and 250 V. branch circuits. Equipped with terminals for open link or cartridge enclosed fuses.

Approved July 5, '08.

(Cuts not available)

LEONARD-BUNDY ELECTRIC CO.,Cleveland, Ohio.

Mutual Standard, 125 and 250 V., 2 and 3 wire, open link, enclosed cartridge and Edison plug fuses. Branch circuit switches up to 15 A. Approved Aug. 10, '06.

Also Mutual Electric Cabinets, iron, slate or iron lining, iron front with solid iron door, or wood trim with glass door, slate or iron lined. Approved Aug. 10, '06.

(Cuts not available)

MUTUAL ELECTRIC & MACHINE CO., Wheeling, W. Va.

"Post-Glover" two and three-wire panelboards, 125, 125-250 and 250 volts. All standard types, branch circuit with open link, Edison plug or cartridge enclosed fuse cutouts, with or without double pole knife or snap switch, with or without main line knife switch and fuse cutout.

Approved Oct. 6, '08.

Also "Post-Glover" Cabinets.

Approved Jan. 24, '06.

(Cuts not available)

POST-GLOVER ELECTRIC CO., Cincinnati, Ohio.

"Royse" two-wire, 125 volt panelboards, with cartridge enclosed or Edison plug fuses in branch circuits, with or without main line switch and enclosed fuse cutout.

Approved May 16, '08.

(Cuts not available)

ROYSE ELECTRIC CO., Indianapolis, Ind.

N. E. Mfg. So., 125-250 V. Panelboards. Type A., 2-wire; type B., 2-wire; type C, 3-wire.

Approved Jan. 29, '07.

Also N. E. Mfg. Co. Cabinets. Slate, sheet iron gutter, oak front, glass door. Approved Jan. 29, '07.

(Cuts not available)

THE NEWPORT ELECTRIC MFG. CO., Newport, Ky.

Nyelec Switchboard Co., two and three-wire panels for 125, 125-250 and 250 V. With cartridge enclosed or open link fuses in branch circuits.

Approved June 24, '08.

(Cuts not available)

NYELEC SWITCH BOARD CO., New York, N. Y.

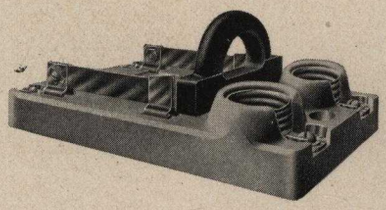
"Wurdack," built up and formed steel cabinets, with or without slate or asbestos gutters. Steel or wood fronts, with or without glass panel in door.

Approved Jan. 18, '08.

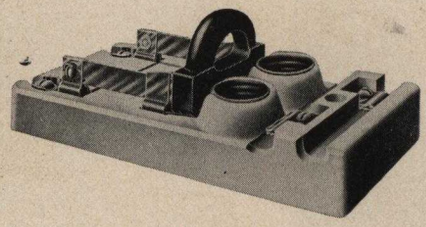
(Cuts not available)

WM. WURDACK ELECTRIC MFG. CO.,St. Louis, Mo.

Banner Entrance Switch and Cutout.



No. 1501 Main.
25 Amp. 220 V.
List Price, $1.00.



No. 1502 Branch
25 Amp. 220 V.
List Price, $1.10.

The entrance switch and plug cutout No. 1501 MAIN is neat in appearance, compact and easy to install.

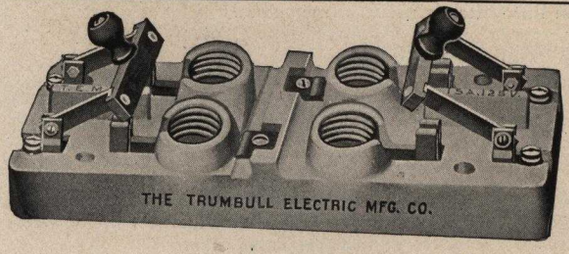
The base is of glazed porcelain, the switch of approved design and well finished. Made for Edison or D. & W. Fuse Plugs.

The combined switch and plug cutout D. P. Branch No. 1502 can be used to advantage in many ways where switch and fuse connections are required. Combinations of these blocks may be used in place of panel or tablet boards, and can be so arranged as to take off branches from one or both sides of the Mains, as may be required, each branch thus being supplied with Switch and Fuse connections.

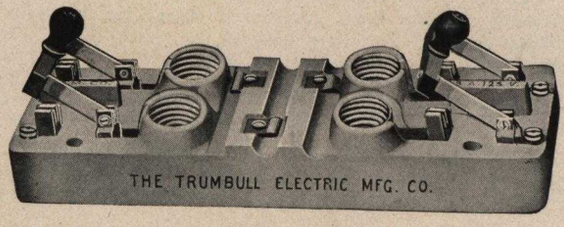
The base is of glazed porcelain, same as No. 1501, and made for Edison or D. & W. Fuse Plugs. Approved April 25, '05.

Special discounts on application.

SPECIALTY MFG. CO., Warren, Ohio.

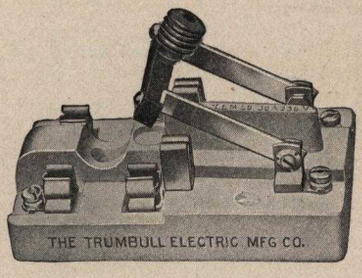


Cat. No. 715.

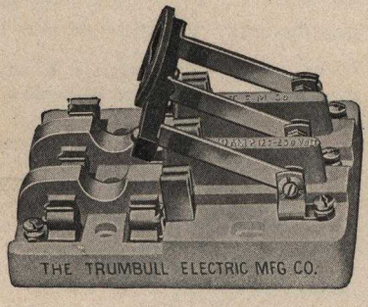


Cat. No. 719.

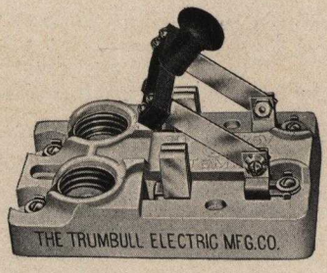
Trumbull Panel Cutouts, with plug fuses, for vertical and horizontal mains, Cat. Nos. 714 and 717, two wire, single branch; Cat. Nos. 715 and 718, two wire double branch; Cat. Nos. 716 and 719, three to two wire, double branch.



Cat. No. 705.



Cat. No. 704.



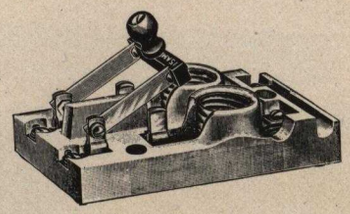
Cat. No. 701.

Porcelain bases, with plug fuses, Cat. No. 701, double pole, 25 A., 125 V. Cat. No. 702, double pole, 25 A., 250 V. Cat. No. 703, three pole, 25 A., 125-250 V.

Also porcelain bases, with cartridge fuse cutout extension, 3 A., 250 V. Cat. Nos. 704 and 724, double pole, for top and bottom connections respectively; Cat. Nos. 705 and 725, three pole, top and bottom connections respectively. Approved Aug. 20, '07.

TRUMBULL ELECTRIC MFG. CO., Plainville, Conn.

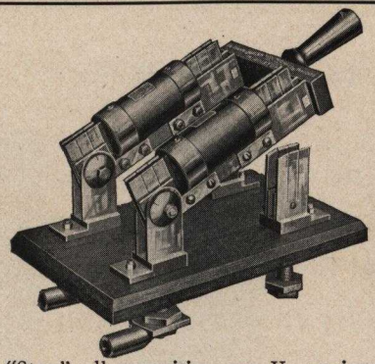
SWITCHES—COMBINATION CUTOUT.—(Continued).



"C. E. M. Co." 15 and 25 A., 125 V., 3 to 2 wire and 2 to 2 wire double branch panel and combination cutouts with plug fuses.

Approved Aug. 2, '07.

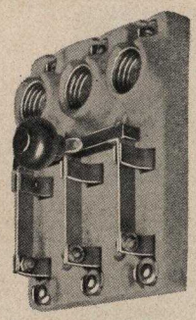
CONN. ELECTRIC MFG. CO., Bantam, Conn.



"Star," all capacities, 250 V., equipped with standard cartridge fuses mounted between cross bar and hinge clips.

Approved June 11, '06.

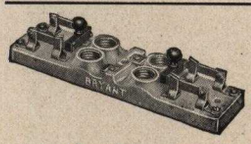
BARKELEW ELEC. MFG. CO., Middletown, O.



"D. & W." Panel Cutouts with knife switch and plug fuses. Cat. Nos. 25028 and 25029, 0-30 A., 125 V.; Cat. Nos. 25030 and 25031, 0-30 A., 250 V.

Approved Oct. 7, '07.

D. & W. FUSE CO., Providence, R. I.

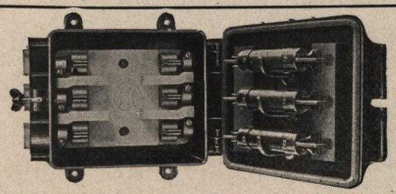


Cat. No. 1852.

Cat. No. 1984.

"Bryant" Knife Switches with Edison plug cutouts. 15 A., 125 V., Cat. Nos. 1851, 1982, 1852, 1983, 1947 and 1984. 25 A., 125 V. Cat. Nos. 1695 and 1981. 25 A., 250 V., all types. Approved Aug. 2, '07.

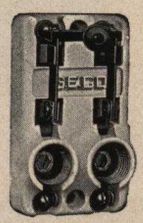
BRYANT ELECTRIC CO., Bridgeport, Conn.



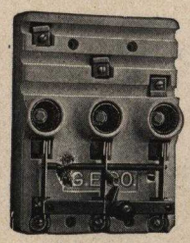
"Noark," 61-600 A., 250 V. Two and three pole. An iron box containing standard cartridge fuses with device for withdrawing fuses from clips when cover of box is opened.

Approved June 5, '06.

H. W. JOHNS-MANVILLE CO., New York, N. Y.



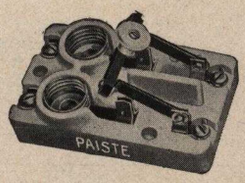
Cat. No. 35367.

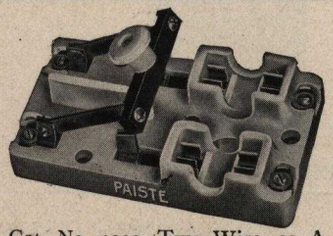


Cat. No. 27747.

G. E., P. C. lever switches with Edison Plug Cutout. Cat. Nos. 35367, 42869, 42688, 42689, 42422, 42423, 42424 and 42425, 15 A., 125 V.; Cat. Nos. 42976, 42977, 35368, 42978, 42979, 35369, 42980 and 35370, 30 A., 250 V.; Cat. Nos. 35371, 42868, 35372 and 42867, 60 A., 250 V. Also Quick Break styles, Cat. Nos. 57711 and 57712, 25 A., 125 V.; Cat. Nos. 27746 and 27747, 30 A., 250 V.; Cat. Nos. 28703 and 28704, 60 A., 250 V. Approved Feb. 28, '07.

GENERAL ELECTRIC CO., Schenectady, N. Y.





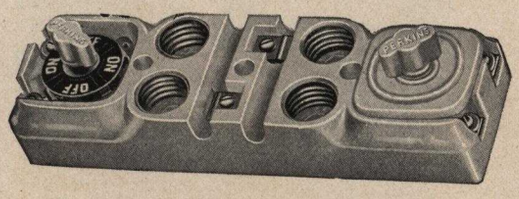
Cat. No. 4014.

Cat. No. 4030, Two Wire, 30 A.

"Paiste" Panel Cutouts, Edison plug fuse bases and knife switches, 15 A., 125 V., Cat. Nos. 4012, 4013, 4015, 4018, 4019, 4026 and 4027; 25 A., 250 V., Cat. Nos. 4101 to 4106 incl. Service Entrance Switches, 25 A., 125 V., Cat. Nos. 4014 and 4016; 30 A., 250 V., Cat. Nos. 4020 to 4025 incl., 4028 and 4029. Entrance Switches with cartridge fuse bases, 0-30 A., and 31-60 A., 250 V. Cat. Nos. 4030-4033 incl. and 5150-5153 incl. Approved Sept. 5, '08.

Also porcelain base plug cutouts with base recessed for approved double pole surface snap switches, 10 A., 125 or 250 V., Cat. Nos. 5190-5193 incl. Approved June 8, '07.

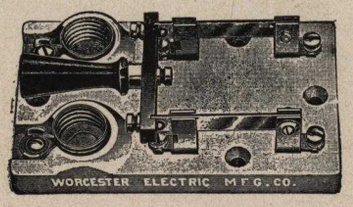
H. T. PAISTE CO., Philadelphia, Pa.



Perkins, 10 A., 250 V., double pole snap switches combined with plug cutouts. Two Wire Double Branch, Cat. No. 2300; three to two wire double branch, Cat. No. 2360; two wire single branch, Cat. No. 2400.

Approved Sept. 25, '06.

PERKINS ELECTRIC SWITCH MFG. CO., Bridgeport, Conn.



Worcester, D. P. porcelain base with cut-out base extension for plug fuses. 25 A., 250 V.

Approved April 14, '08.

WORCESTER ELEC. MFG. CO., Worcester, Mass.

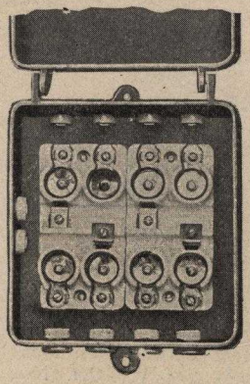
"Heineman" service entrance switches, 30 A., 250 V. Porcelain base knife switches with holders for Edison plug fuses, Cat. Nos. 211 and 221, double and three pole types. Approved Sept. 30, '08. (Cuts not available).

GEO. HEINEMAN & CO., 500-508 Girard Ave., Philadelphia, Pa.

"H. R. E. Co." 25 A., 125 V. Knife switch with plug fuse cutout extension. Approved April 2, '07. (Cuts not available).

HOLABIRD-REYNOLDS ELECTRIC CO., Los Angeles, Cal.

IRON CABINETS FOR CUTOUTS AND COMBINATION SWITCHES.



No. 14—4 Circuits.
Lots of 10—$3.00 each net

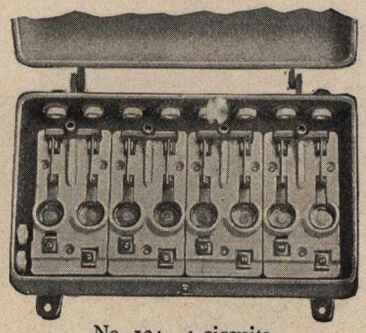
"Teco" Iron Boxes.

Lots of 10 may be assorted sizes. Price includes Switch and Cutout as shown.

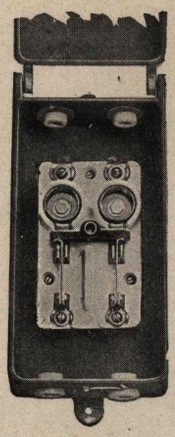
These Panel Boxes are made in 12 styles. Catalogue shows all types and gives prices.

Std. Pkg. 10 assorted.

Approved Sept. 13, 1906.



No. 124—4 circuits.
Lots of 10—$5.70 net.



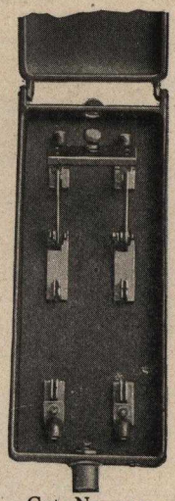
Cat. No. 120.
Lots 10—$1.00 each net.

"Teco" Metal Cabinets and cast iron boxes for service entrance switch and cutouts, used either with conduit or open wiring. For any number of poles or any ampere capacity. For Flush or concealed work.

Prices complete with switch as shown in cut. All goods New Code. Catalogue and Price List on request.

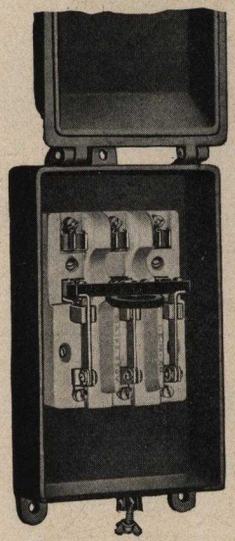
Approved Sept. 13, 1906.

TROY ELECTRICAL CO., Troy, N. Y.



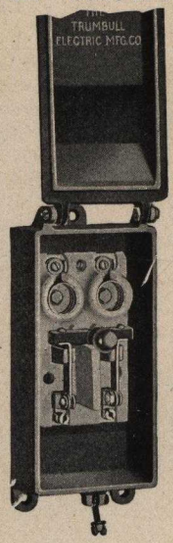
Cat. No. 2210.
Lots 10—$4.80 each net

"Trumbull" Cast Iron Boxes.

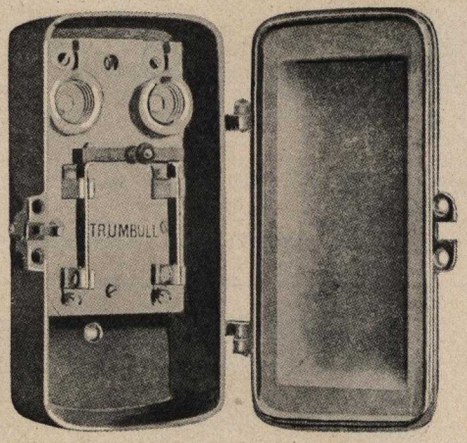


Cat. No. 3635.

Equipped for Gasket.
Drilled for Conduit.
or without Bushings.



Cat. No. 3632.

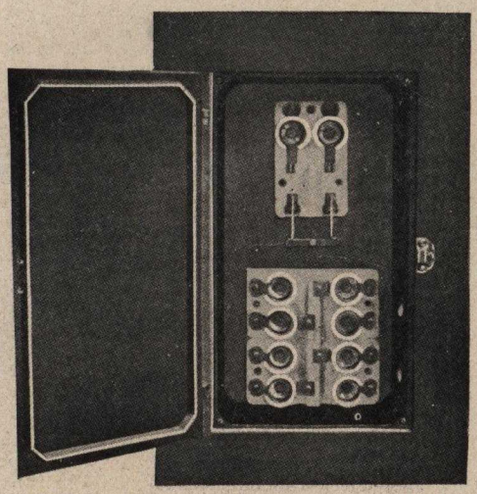


Cat. No. 1212.

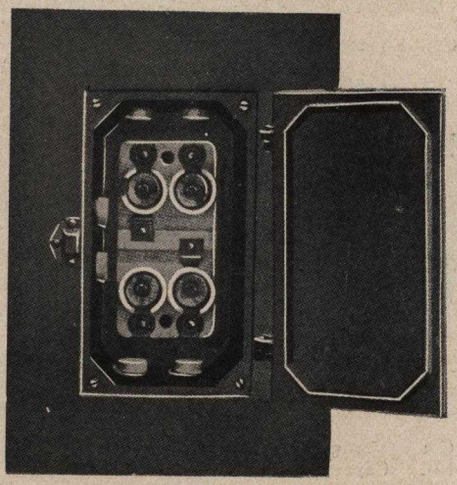
Cast iron boxes for service entrance cutouts and switches used with open wiring or with conduit work. Cat. Nos. 1210 for double pole 125 V. switch, No. 1212 for double pole 250 V. switch and No. 1214 for triple pole 250 V. switch. Also Cat. Nos. 3601, 3603, 3605, 3620 to 3625 incl., and 3630 to 3637 incl. Drilled for conduits or with bushings, and without bushings or conduit holes. Approved Jan. 2, '08.

TRUMBULL ELECTRIC MFG. CO., Plainville, Conn.

Wright Cutout Cabinets.



Edison plug cut-out, and switch or both.



Cast iron boxes enclosing bases, or combination plug.

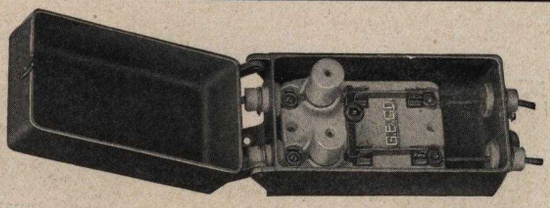
These cabinets are made of 1/8 in. cast iron to fit in 3 in. partitions. These cabinets are finished with a black insulating compound, preventing rust and can be furnished with iron or wood trim or without trim of any kind. Made either for conduit, tube or knob work as ordered. Approved July 5, '06.

Send for price list and circulars.

Sandy Hill. **WRIGHT ELECTRIC CO.** **New York.**

Paiste. Cast iron box enclosing an approved cutout base or combination switch and cutout. Edison plug or cartridge fuses. Approved Sept. 10, '07.

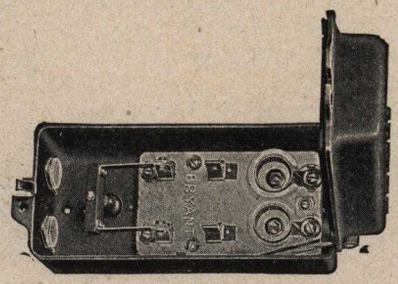
H. T. PAISTE CO., Philadelphia, Pa.



G. E. Cast iron boxes with combination Plug Fuse Cutouts and Lever Switches, for service entrance work. Cat. Nos. 45008 to 45017 incl.

Approved Oct. 1, '07.

GENERAL ELECTRIC CO., Schenectady, N. Y.



Bryant cast iron boxes for combination plug fuse cutouts and knife switches for service entrance work. Cat. Nos. 358, 359, 360 for open work. Cat. Nos. 378, 379, 380 for rigid conduit. Approved Oct. 5, '08.

BRYANT ELECTRIC CO., Bridgeport, Conn.

"Burns" cast iron cabinets for mounting service entrance switches. Cat. No. 410, 415 and 420.

Approved Aug. 11, '08.

JAS. F. BURNS, 47 N. Hutchinson St., Philadelphia, Pa.

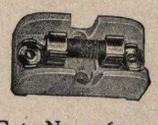
Pressed steel boxes for service entrance switches. Approved March 20, '08.

ELECTRIC MANUFACTURING CO., New Orleans, La.

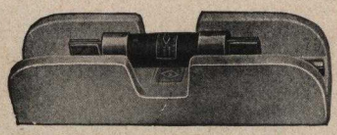
"Columbia" pressed steel cabinets for porcelain base service entrance switches or combination cutouts. For use with rigid metal conduit. Approved Oct. 5, '08.

COLUMBIA METAL BOX CO., New York, N. Y.

CUTOUT BASES—CARTRIDGE FUSE.

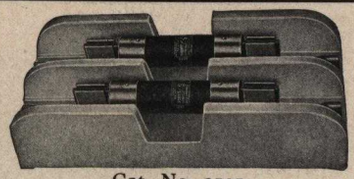


Cat. No 20675.



Cat. No. 20695.

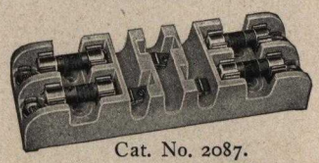
Cat. No. 2071.



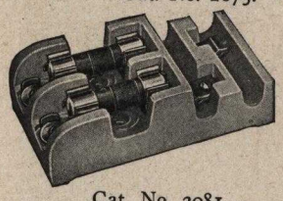
Cat. No. 2101.

Cat. No. 2075.

Cat. No. 2095.



Cat. No. 2087.



Cat. No. 2081.

"Shawmut." All capacities, 250 and 600 V.

Approved Aug. 29, '05.

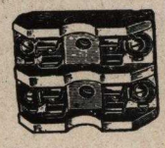
Cat. No. 2077.

Cat. No.	Amp; Capacity	Volt-age	Description	Std. Pkg.	List Price Ea.
20675	0-30	250	Single Pole Main Line	(Porc.) 50	.40
2067	0-30	250	" " "	(Slate) 50	.40
20685	31-60	250	" " "	(Porc.) 50	.75
2068	31-60	250	" " "	(Slate) 50	.75
20695	61-100	250	" " "	(Porc.) 50	1.40
2069	61-100	250	" " "	(Slate) 50	1.40
2070	101-200	250	" " "	(Slate) 50	2.75
2071	201-400	250	" " "	(Slate) 25	7.00
2072	401-600	250	" " "	(Slate) 10	11.00
2077	0-30	250	Double Pole Main Line	(Porc.) 50	.60
2078	31-60	250	" " "	(Porc.) 50	1.60
2101	61-100	250	" " "	(Porc.) 50	2.80
2079	0-30	250	Triple Pole Main Line	(Porc.) 50	.90
2080	31-60	250	" " "	(Porc.) 50	2.35
2102	61-100	250	" " "	(Porc.) 25	4.00
2081	0-30	250	Double Pole single Br.	(Porc.) 50	.80
2082	31-60	250	" " " "	50	2.10
2083	0-30	250	Triple Pole Single Br.	(Porc.) 50	1.35
2084	31-60	250	" " " "	50	3.00
2085	0-30	250	Double Pole Double Br.	(Porc.) 25	1.30
2086	31-60	250	Double Pole Double Br.	(Porc.) 25	4.00
20835	0-30	250	Triple Pole Double Br.	(Porc.) 25	2.25
20845	31-60	250	" " " "	10	8.00
2087	0-30	250	3 to 2-wire Double Br.	(Porc.) 25	1.50
2088	31-60	250	" " " "	25	5.00
20875	0-30	250	2-wire Cross-over Br.	(Porc.) 50	.80
20735	0-30	600	Single Pole Main Line	(Porc.) 50	.60
2073	0-30	600	" " "	(Slate) 50	.60
20745	31-60	600	" " "	(Porc.) 50	.90
2074	31-60	600	" " "	(Slate) 50	.90
2075	61-100	600	" " " "	50	1.75
2076	101-200	600	" " " "	50	3.00
2095	201-400	600	" " " "	25	8.00
2096	401-600	600	" " " "	10	12.00

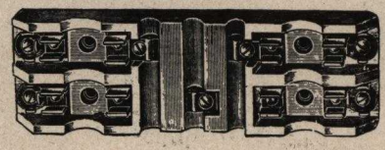
CHASE-SHAWMUT CO., Newburyport, Mass.

Cat. No. 7944.

Cat. No. 7936.

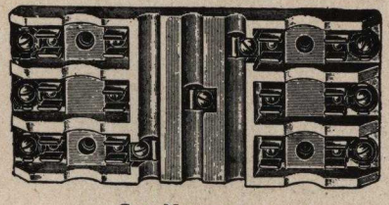


Cat. No. 7937.



Cat. No. 7942.

Cat. No. 7939.

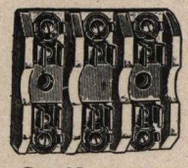


Cat. No. 7943.

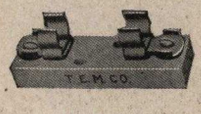
Cat. No.	Style.	Std. Pkg.
7936	Single Pole, Main	50
7937	Two Wire, Main	50
7938	Three Wire, Main	50
7939	Two Wire, Single Br.	50
7940	Three Wire, Single Br.	50
7941	Two Wire, Double Br.	25
7942	3 to 2 Wire, Double Br.	25
7943	Three Wire, Double Br.	25
7944	Two Wire, Cross Over	50

"Mesco" Porcelain Bases, 0-30 A., 250 V. All Styles.
Approved July 24, '06.

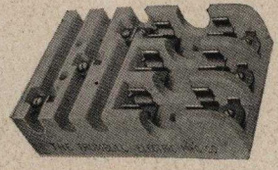
MANHATTAN ELECTRICAL SUPPLY CO., New York, N. Y.



Cat. No. 7938.



Cat. No. 25693.



Cat. No. 80423.

Cat. No. 21993.

Cat. No. 29653.

0-30 A., 250 V.

Cat. No.	Style.	Std. Pkg.
25693	Single P. Main	50
29653	Double P. Main	50
21653	Triple P. Main	50
19353	Double P., Single Br.	50
25873	Double P., Double Br.	25
80423	Triple P., Single Br.	50
21353	Triple P., Double Br.	25
21993	3 to 2 P., Double Br.	25

31-60 A., 250 V.

Cat. No.	Style.	Std. Pkg.
25696	Single P. Main	50
29656	Double P. Main	50
21656	Triple P. Main	50
19356	Double P., Single Br.	50
25876	Double P., Double Br.	25
80426	Triple P., Single Br.	50
21356	Triple P., Double Br.	10
21996	3 to 2 P., Double Br.	25

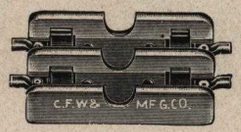
Trumbull, 0-30 and 31-60 A. 250 V., all styles, single, double and triple pole, Main line, double and triple pole, single and double branch and 3 to 2 pole, double branch. Approved July 23, '06.

TRUMBULL ELEC. MFG. CO., Plainville, Conn.

CUTOUT BASES,—CARTRIDGE FUSE—(Continued.)

Cat. No. 2010. 3-30 A.

Cat. No. 2021. 31-60 A.



Cat. No. 2014. 61-100 A.

Cat. No. 2006. 101-200 A.

Cat. No. 2007. 201-400 A.

Cat. No. 2008. 401-600 A.

250 Volts, 0-600 Amperes.

Cat. No.	Amp.	Description	Std. Pkg.	Price
2003	3-30	One Wire Main	50	$0.40
2010	3-30	Two Wire Main	50	.60
2012	3-30	Three Wire Main	50	.90
2020	3-30	2 Wire, 2 pole, Sing. Brch.	50	.80
2022	3-30	3 Wire, 3 pole, Sing. Brch.	50	1.35
2025	3-30	2 Wire, 2 pole, Dbl. Brch.	25	1.30
2029	3-30	3 Wire, 3 pole, Dbl. Brch.	25	2.25
2027	3-30	3 Wire, 2 pole, Dbl. Brch.	25	1.50
2004	31-60	One Wire Main	50	.75
2011	31-60	Two Wire Main	50	1.60
2013	31-60	Three Wire Main	50	2.35

Cat. No.	Amp.	Description	Std. Pkg.	Price
2021	31-60	2 Wire, 2 pole, Sing. Brch.	50.	$2.10
2023	31-60	3 Wire, 3 pole, Sing. Brch.	50	3.00
2026	31-60	2 Wire, 2 pole, Dbl. Brch.	25	4.00
2030	31-60	3 Wire, 3 pole, Dbl. Brch.	10	8.00
2028	31-60	3 Wire, 2 pole, Dbl. Brch.	25	5.00
2005	61-100	Sing. Pole Main line	50	1.40
2014	61-100	Dbl. pole Main line	50	2.80
2015	61-100	Three pole Main line	25	4.00
2006	101-200	Sing. pole Main line	50	2.75
2007	201-400	Sing. pole Main line	25	7.00
2008	401-600	Sing pole Main line	10	11.00

600 Volts, 0-40 Amperes.

Cat. No. 4003. 3-30 A.

Cat. No. 4004. 31-60 A.

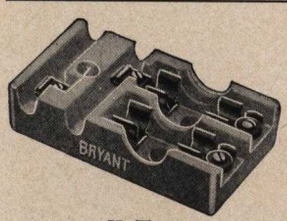
Cat. No. 4007. 201-400 A.

Cat. No.	Amp.	Description	Std. Pkg.	List Price
4003	3- 30	One Wire Main	50	$0.60
4004	31- 60	One Wire Main	50	.90
4005	61-100	One Wire Main	50	1.75

Cat. No.	Amp.	Description	Std. Pkg.	List Price
4006	101-200	One Wire Main	25	$3.00
4007	201-400	One Wire Main	25	8.00
4008	401-600	One Wire Main	10	12.00

Approved May 25, '07.

Chicago: 170 S. Clinton St. **CHICAGO FUSE WIRE & MFG. CO.,** **New York: 90 W. Broadway.**



250 V. Types.

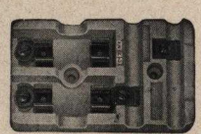
600 V. Types.

Bryant 1905 Standard type, all classifications, 250 and 600 V. Approved July 19, '05.

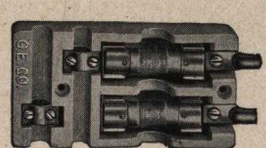
Also Bryant Fuse Base Adapters, types A to G incl., 0-30 and 31-60 A. classification 250 and 600 V., permitting the use of Nat. Elec. Code Standard Cartridge enclosed fuses on older patterns of cutout blocks.

Approved June 8, '08.

BRYANT ELECTRIC CO., Bridgeport, Conn.



250 V. 0-30 A.



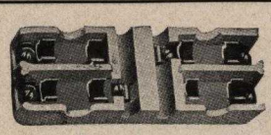
250 V. 31-60 A.

250 V. 61-600 A.

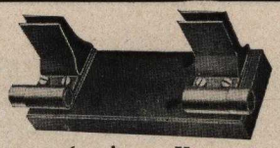
G. E. all classifications, 250 and 600 V. Approved Oct. 23, '05. Also single pole porcelain base types for use with G. E. glass tube fuses. Approved on switchboards with fuses protecting instruments or pilot lights. Approved Nov. 25, '07.

GENERAL ELECTRIC CO., Schenectady, N. Y.

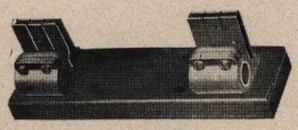
CUTOUT BASES,—CARTRIDGE FUSE—(Continued.)



0-30 A. 250 V.



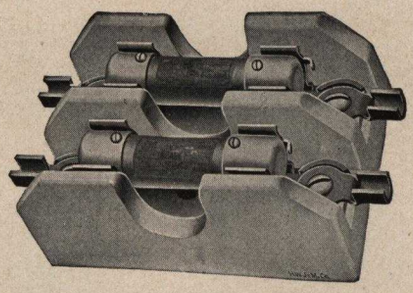
101-600 A. 250 V.



0-600 A. 600 V.

"D. & W." 1905 Standard type, all capacities, 250 and 600 V. Approved Nov. 15, '05.

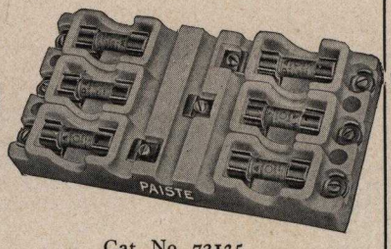
D. & W. FUSE CO., Providence, R. I.



"Noark" Standard type, all classifications, 250 and 600 V. Approved March 4, '07.

H. W. JOHNS-MANVILLE CO., New York, N. Y.

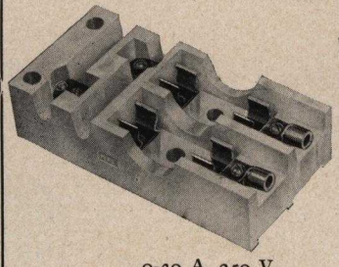
Cat. No. 72965.



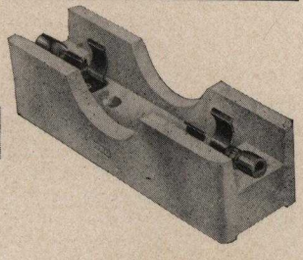
Cat. No. 72135.

"Paiste" all standard patterns, 3-30 and 31-60 A., 250 V. Approved June 17, '08.

H. T. PAISTE CO., Philadelphia, Pa.



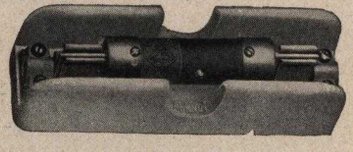
0-30 A. 250 V.



31-60 A. 600 V.

"Peru" Main and branch blocks, 0-200 A., 250 V., 0-100 A., 600 V. Approved Nov. 20, '07.

PERU ELECTRIC MFG. CO., Peru, Ind.

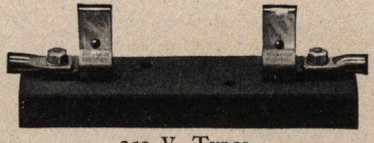


250 V. Types.

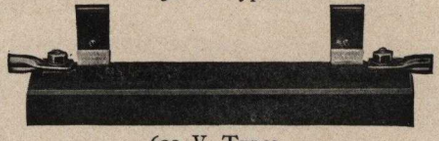
600 V. Types.

"Sachs." Porcelain and slate bases, all capacities, 250 and 600 V. Approved March 4, '07.

THE SACHS COMPANY, Hartford, Conn.



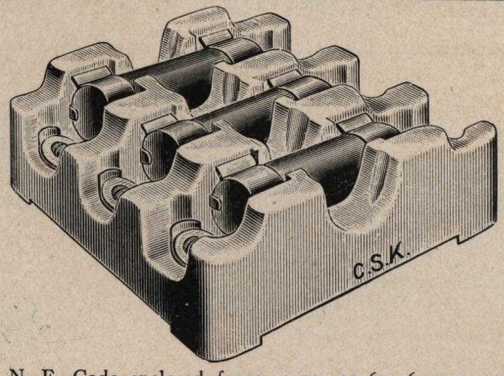
250 V. Types.



600 V. Types.

"Westinghouse." 1905 standard types, all classifications, 250 and 600 V. Approved July 19, '05.

WESTINGHOUSE ELEC. & MFG. CO., Pittsburg, Pa.



"Knowles." Main line cutouts for N. E. Code enclosed fuses, 3-30, 31-60, 61-100, 101-200 A., 250 V.; 61-100 A., 600 V. Approved Sept. 10, '07.

C. S. KNOWLES, Boston, Mass.

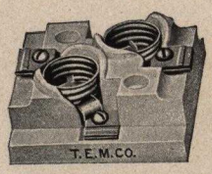
"Trio" 1905 Standard type slate bases, 0-300 A., 250 V., and 600 V., one, two, three, and four pole. Approved Dec. 17, '07.
(Cuts not available.)

TRIO MANUFACTURING CO., Rock Island, Ill.

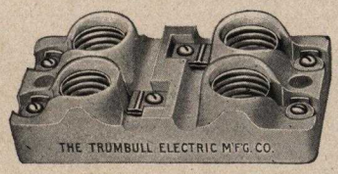
"B-P." All capacities, 250 and 600 V. Porcelain and slate bases. Approved Nov. 8, '07.
(Cuts not available.)

WOOLLEY ELECTRIC CO., St. Louis, Mo.

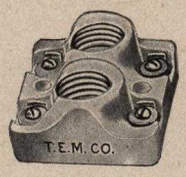
CUTOUT BASES,—PLUG FUSE.



No. 8020.



No. 2587.



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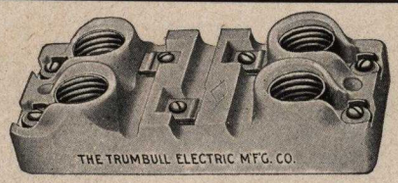

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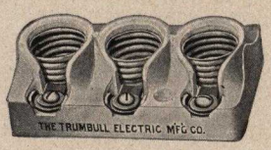
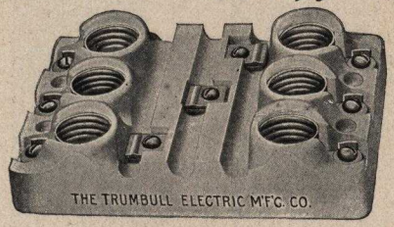


No. 2165



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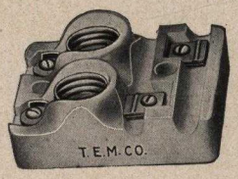


No. 1935.

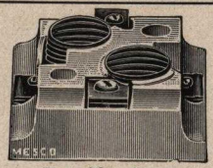
Cat. No.	Style	Std. Pkg.
2569	1 Pole Main	150
2965	2 Pole Main	150
2165	3 Pole Main	100
1935	2 Pole, Single Br.	100
2587	2 Pole, Double Br.	100
8042	3 Pole, Single Br.	75
2135	3 Pole, Double Br.	50
2199	3 to 2 P., Double Br.	100
8020	2 Pole, Single to Double Cross Over	150

"Trumbull" Porcelain Bases, 0-30 A, 250 V. Approved June 28, '06.

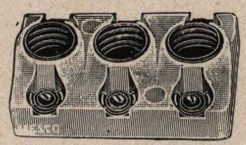
TRUMBULL ELECTRIC MFG. CO., Plainville, Conn.

Cat. No. 62965.

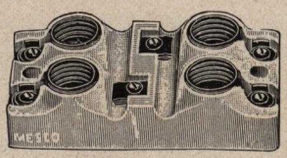
Cat. No. 61935.



Cat. No. 8020.

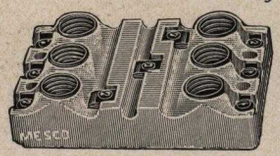


Cat. No. 62165



Cat. No. 62587.

Cat. No. 62199.

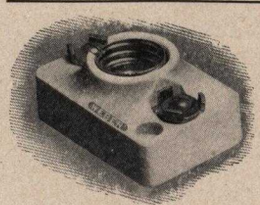


Cat. No. 62135.

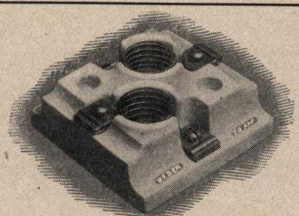
Cat. No.	Style	Std. Pkg.
62569	Single P. Main	150
62965	Double P. Main	150
62165	Triple P. Main	100
61935	Double P., Single Br.	100
8042	Triple P., Single Br.	75
62587	Double P., Double Br.	100
62135	Triple P., Double Br.	50
62199	Triple to Double P.	50
8020	Double P., Single or Double Cross Over	150

"Mesco." 0-30 A. 250 V. Porcelain bases. All types. Approved July 25, '06.

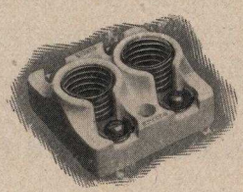
MANHATTAN ELECTRIC SUPPLY CO., New York, N. Y.



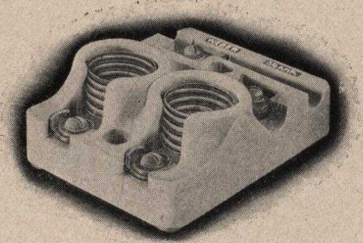
Cat. No. 62569.



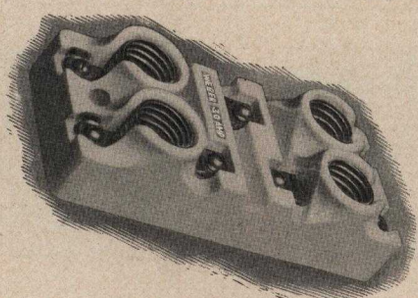
Cat. No. 8020.



Cat. No. 62965.



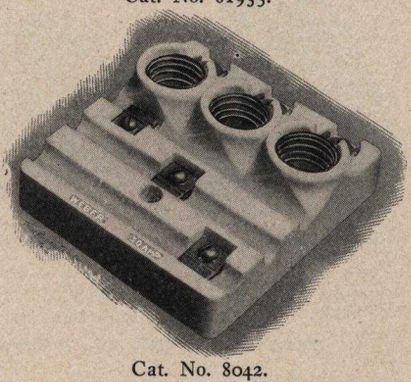
Cat. No. 61935.



Cat. No. 62199.

Cat. No.	Style	Std. Pkg.
62569	Single P., Main L.	150
62965	Double P., Main L.	150
61935	Double P., Single Br.	100
62165	Three Wire Main	100
8020	D. P. Single or Double Cross Over	150
62587	Double P., Double Br.	100
62199	3 to 2 Wire, Double Br.	100
8042	Three Wire, Single Br.	75
62135	Three Wire, Double Br.	50

Approved May 13, '05



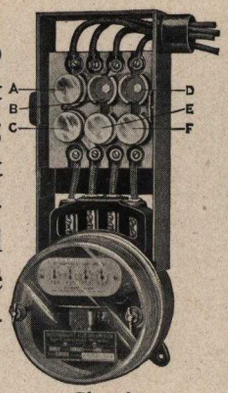
Cat. No. 8042.

HENRY D. SEARS, General Sales Agent,
131 State St., Boston, Mass.

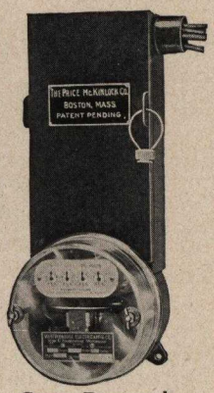
O. K. Connection Block.

For Facilitating Meter Inspection.

This device is designed to facilitate the inspection, test and replacement of meters; and by its use any desired test can be made, or the meter removed and a new one installed without manipulating service wires or interfering with customer's lights in any way whatever.



Closed

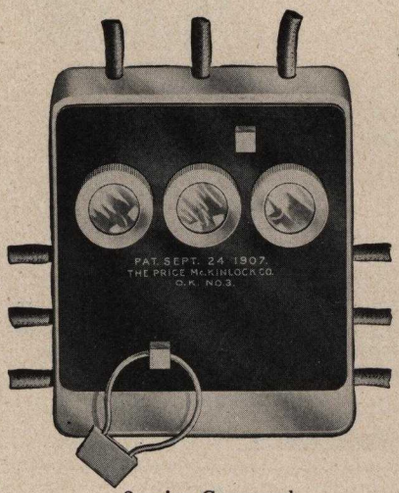


Cover Removed

It is applicable to all classes of construction, and of particular value in services where the wires are carried in conduit from entrance switch to meter; as thc conduit may be terminated so that no wires or bare contacts are exposed except by opening a sealed cover.

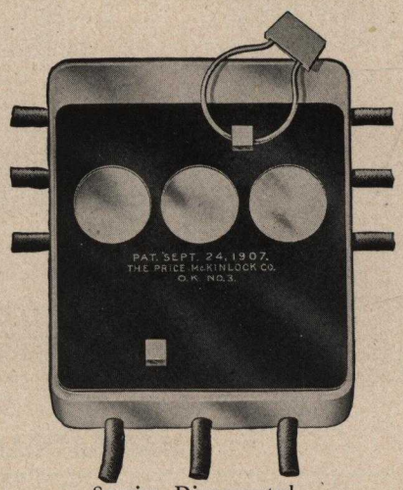
O. K. Fuse Block Cover.

For Preventing Theft of Current.



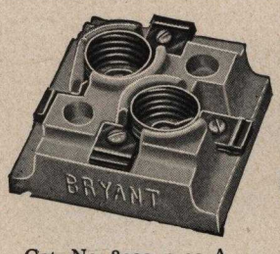
Service Connected

Where most needed. In apartment house wiring and similar classes of service where several customers have meters on the premises, it is very desirable that all bare conductors be so covered that it is impossible to cut in extra lamps, etc., without leaving the wiring in such condition that this unauthorized work is apparent upon inspection. It is equally desirable in the case of discontinued service to be able to seal the branch block so that it is impossible to fuse same or make illegal connections without breaking a seal.

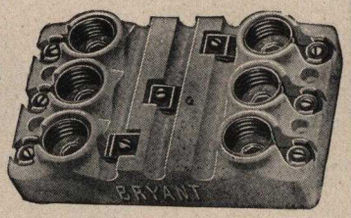


Service Disconnected

PETTINGELL-ANDREWS COMPANY, Boston, Mass.

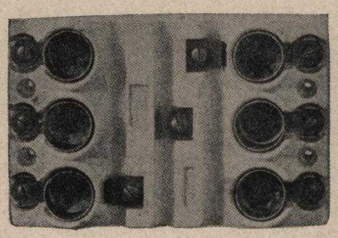


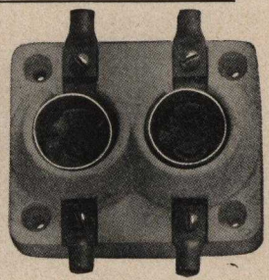
Cat. No. 8020, 0-30 A.



Cat. No. 62135, 0-30 A.

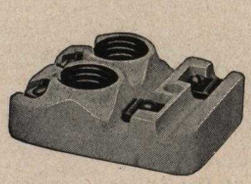
Bryant, 0-30 and 31-60 A., 250 V.
Approved April 30, '06.
BRYANT ELECTRIC CO., Bridgeport, Conn.


0-30 A. 250 V.

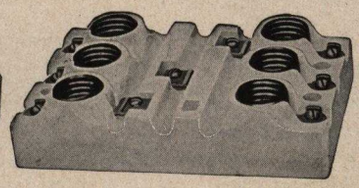

31-60 A. 250 V.

G. E. 0-30 and 31-60 A., 250 V. Approved Nov. 25, '04.
Also G. E. with porcelain covers, 0-30 A. 250 V. all types.
Approved July 5, '06.
GENERAL ELECTRIC CO., Schenectady, N. Y.

CUTOUT BASES,—PLUG FUSE.—(Continued),—CUTOUT BASES,—LINK FUSE and CUTOUT BASES, MAGNETIC BLOWOUT.



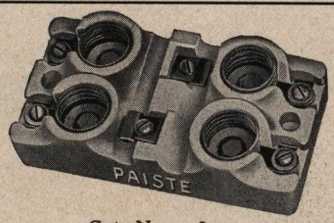
Cat. No. 1935



Cat. No. 2135

"M. S." porcelain bases, 0-31 A., 250 V., all types. Approved July 24, '06.

MARSHALL ELECTRIC MFG. CO., Boston, Mass.



Cat. No. 2587.

Cat. No. 8020.

"Paiste" Edison type, 3-30 A., 250 V., all types. Approved Dec. 12, '04.

H. T. PAISTE CO., Philadelphia, Pa.

"Freeman." 2 to 2 wire and 3 to 2 wire main line single and double branch blocks. Approved Oct. 30, '07.
(Cuts not available.)

E. H. FREMAN ELECTRIC CO., Trenton, N. J.

Harter Glass. 0-30 A., 250 V. Glass bases cast directly about metal parts. All types. Approved Nov. 26, '07.
(Cuts not available.)

HARTER ELECTRIC CO., Chicago, Ill.

Holabird-Reynolds. 0-30 A., 250 V., double pole main to branch circuit porcelain cutout. Cat. No. 1935. Approved Jan. 29, '07.
(Cuts not available.)

HOLABIRD-REYNOLDS CO., Los Angeles, Cal.

CUTOUT BASES,—LINK FUSE.

Westinghouse lignum vitae blocks for aluminum fuses. Approved Dec. 14, '04.

WESTINGHOUSE ELECTRIC & MFG. CO., Pittsburg, Pa.

CUTOUT BASES,—MAGNETIC BLOWOUT.

G. E. for magnetic blowout fuse. Approved Nov. 25, '04. Approved for use on switchboards and fire proof rooms.

GENERAL ELECTRIC CO., Schenectady, N. Y.

FUSES,—CARTRIDGE ENCLOSED.

Shawmut Enclosed Fuses.

Cat. No. 2010.
Construction of Fuses
from 3 to 60 Amperes.

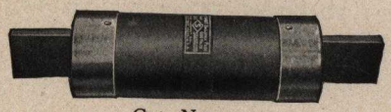
Cat. No. 2022.
Construction of Fuses
from 61 to 200 Amperes.

Cat. No. 2034.
Construction of Fuses
from 201 to 600 Amperes.

250 Volts and under—Green Labels.

Cat. No. 2048.
Construction of Fuses
from 3 to 60 Amperes.

Cat. No. 2060.
Construction of Fuses
from 61 to 200 Amperes.



Cat. No. 2094.
Construction of Fuses
from 201 to 600 Amperes.

251—600 Volts—Red Labels.

250 Volts and Under

Cat. No.	Ampere Capacity	Std. Pkg.	List Price Each	Refilling List Price Each
2001-2010	0- 30	100	$0.25 }	Not
2011-2016	31- 60	100	.33 }	Refillable
2017-2022	61-100	50	.86	.57
2023-2028	101-200	25	2.00	.90
2029-2034	201-400	25	3.40	1.48
2035-2038	401-600	10	5.20	2.00

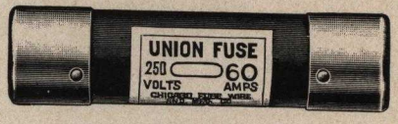
251-600 Volts

Cat. No.	Ampere Capacity	Std. Pkg.	List Price Each	Refilling List Price Each
2039-2048	0- 30	100	$0.38 }	Not
2049-2054	31- 60	100	.44 }	Refillable
2055-2060	61-100	50	1.20	.80
2061-2066	101-200	25	2.50	1.20
2089-2094	201-400	25	5.25	2.00
2097-2100	401-600	10	8.00	3.00

"Shawmut" Standard type, all capacities, 250 and 600 volts. Approved Apr. 22, '07.

CHASE-SHAWMUT CO., Newburyport, Mass.

"Union" Enclosed Fuses.



250 V. 3-60 A.
Ferrule Contact.

600 V. 3-60 A.
Ferrule Contact

250 V. 65-600 A.
Knife Blade Contact.

600 V. 65-600 A.
Knife Blade Contact.

250 Volt Types

Amp.	Length Over All	Diam. of Tube	Carton Quan.	Std. Pkg.	List Price	Refill Price
3- 30	2"	½"	50	100	$0.25	.....
31- 60	3"	¾"	25	100	.33	$0.29
61-100	5⅞"	1"	10	50	.86	.57
101-200	7⅓"	1½"	5	25	2.00	.90
201-400	8⅝"	2"	2	25	3.40	1.48
401-600	10⅜"	2½"	2	10	5.20	2.00

600 Volt Types

Amp.	Length Over All	Diam. of Tube	Carton Quan.	Std. Pkg.	List Price	Refill Price
3- 30	5"	¾"	10	100	$0.38	$0.35
31- 60	5½"	1"	10	50	.44	.40
61-100	7⅞"	1¼"	5	50	1.20	.80
101-200	9⅝"	1¾"	2	25	2.50	1.20
201-400	11⅝"	2½"	1	25	5.25	2.00
401-600	13⅜"	3"	1	10	8.00	3.00

TRADE MARK UNION

"Union" Enclosed Fuses, 250 and 600 V. Approved Jan. 29, '07.

TRADE MARK UNION

Chicago:
170 S. Clinton St.

CHICAGO FUSE WIRE & MFG. CO.,

New York:
90 W. Broadway.

FUSES,—CARTRIDGE ENCLOSED.—(Continued).

0-30 A. 250 V. Not blown. Both end and side holes of shell are open.

0-30 A. 250 V. Blown. Holes in end of fuse shell closed.

"Arkless" Fuses.

"Arkless" fuses are equipped with a mechanical indicator consisting of a phosphor bronze spring, held by a fine wire to the fuse strip within the case. When the fuse blows this spring is released and indicates clearly and unmistakably the condition of the fuse. Every "Arkless" fuse is guaranteed by the manufacturer to indicate when blown. As the indicator stands out prominently it eliminates all testing or hunting around for blown fuses.

The 0-30 ampere type indicates in Plug Cases as clearly as in Panels.

61-100 Amp. 600 Volt. Fuse Blown. Note indicator spring stands out so as to be plainly visible even from a distance.

Same fuse cut away showing inside construction. As the fusible strip is weakened in the center, the spring is always released when the fuse blows.

250 Volts, 0-600 Amperes.

Cat. No.	Amp.	Carton Quan.	Std. Pkg.	List Price	Refill Price
3103-3130	3- 30	50	100	$0.25	.....
3135-3160	35- 60	25	100	.33	.....
3165-3200	65-100	10	50	.86	.57
3210-3300	110-200	1	25	2.00	.90
3325-3500	225-400	1	25	3.40	1.48
3550-3700	450-600	1	10	5.20	2.00

600 Volts, 0-400 Amperes.

Cat. No.	Amp.	Carton Quan.	Std Pkg.	List Price	Refill Price
6003-6030	3- 30	25	100	$0.38	.....
6035-6060	35- 60	10	100	.44	.....
6065-6100	65-100	5	50	1.20	.80
6110-6200	110-200	1	25	2.50	1.20
6225-6400	225-400	1	25	5.25	2.00

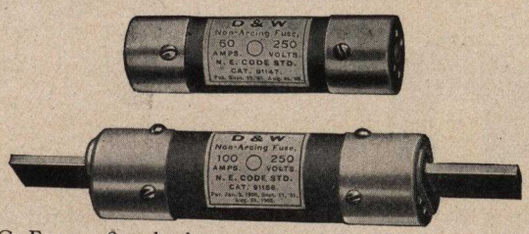
O-60 Amperes spring clip type not refillable.

"Arkless" National Electrical Code Standard. All capacities. 250 and 600 volts. Approved April 29, 1908.

DETROIT FUSE & MANUFACTURING CO., 40-46 Champlain St., Detroit, Mich.

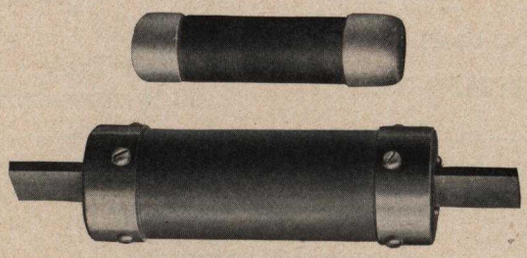
Bryant 1905 Standard type, 250 and 600 V. Approved Dec. 10, '04. Also glass tube enclosed fuses, 1, 2 and 3 A., 250 V., Cat. Nos. 348, 284 and 349. Approved Aug. 28, '08.

BRYANT ELECTRIC CO., Bridgeport, Conn.



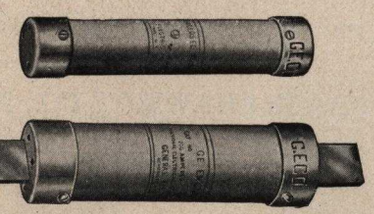
G. E. 1905 Standard type, 250 and 600 V. Approved May 16, '05. Also Small glass tube fuses, 2 A., 250 V., Cat. No. 32579. Approved Aug. 14, '07.

GENERAL ELECTRIC CO., Schenectady, N. Y.



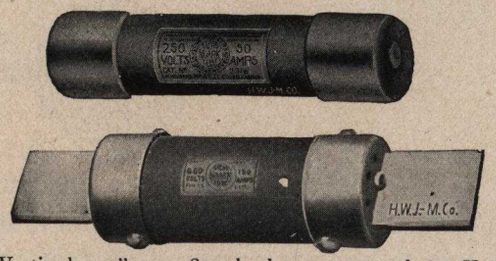
"D. & W." 1905 Standard type, 250 and 600 V. Approved Dec. 10, '04.

D. & W. FUSE CO., Providence, R. I.



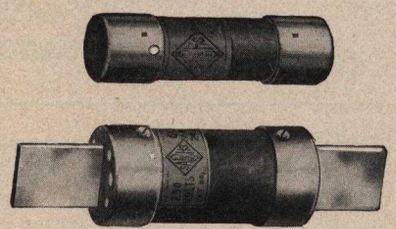
, "Noark" Standard type, all capacities, 250 and 600 V. Approved March 4, '07.

H. W. JOHNS-MANVILLE CO., New York, N. Y.



"Westinghouse" 1905 Standard type, 250 and 600 V. Approved May 16, '05.

WESTINGHOUSE ELEC. & MFG. CO., Pittsburg, Pa.



"Sachs." All capacities, 250 and 600 V. Approved March 4, '07.

THE SACHS COMPANY, Hartford, Conn.

"B. P." All capacities 250 V. Approved Nov. 8, '07.
(Cuts not available.)

WOOLLEY ELECTRIC CO., St. Louis, Mo.

FUSES,—OPEN LINK.

"Shawmut" Open Link Fuses.

Amperes	Term. No.	To 1½ inch Centers Per 100	To 3½ inch Centers Per 100	To 5 inch Centers Per 100	Standard Package
1 to 5	1	2.00	3.00	4.00	100 of one Size
5 to 30	2½	3.00	4.00	5.00	
35 to 100	3	3.00	5.00	6.00	
35 to 100	4	4.00	6.00	8.00	
		To 2½ inch Centers Per 100	To 5 inch Centers Per 100	To 8 inch Centers Per 100	
25 to 100	5	10.00	15.00	20.00	50 of Asst'd Sizes
110 to 200	5 or 6	12.00	18.00	24.00	
210 to 400	6	15.00	22.50	30.00	
410 to 600	6	20.00	30.00	40.00	
		To 5 inch Centers Per 100	To 8 inch Centers Per 100		
100 to 400	8	25.00	40.00		25 of Asst'd Sizes
410 to 600	8	40.00	60.00		
610 to 800	8	55.00	80.00		
810 to 1000	8	75.00	100.00		
		To 4 inch Centers Per 100	To 8 inch Centers Per 100		
100 to 200	10c	40.00	60.00		25 of Asst'd Sizes.
210 to 400	10c	45.00	70.00		
410 to 600	10c	50.00	80.00		
610 to 800	10c	60.00	90.00		
810 to 1000	10c	75.00	110.00		

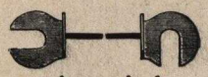
Fuses larger than 1,000 Amp. charged at a proportionate advance in price.

Approved Nov. 30, '04.

CHASE-SHAWMUT CO., Newburyport, Mass.

1B terminal
Slots ⅛ inch.

2½B terminal
Slots 3/16 inch.



3A terminal
Slots 7/32 inch.

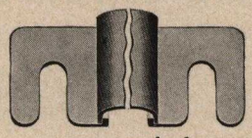
4A terminal
Slots ¼ inch.

5A terminal
Slots ⅜ inch

5½A terminal
Slots 7/16 inch.

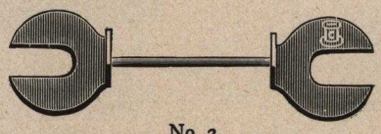
6A terminal
Slots ½ inch.

8A terminal
Slots ¾ inch.



10c terminal
Slots 11/16 inch.

No. 00



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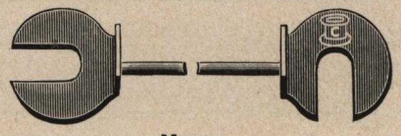

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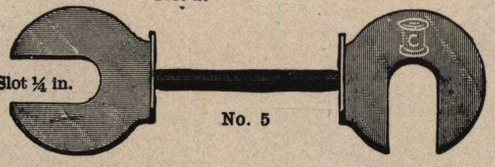


"Union" Open Link Fuses, in capacities from 1 to 5000 A. equipped with standard terminals. These terminals are made up in fourteen different sizes and are designed to secure ample contact area and perfect connecting surface.

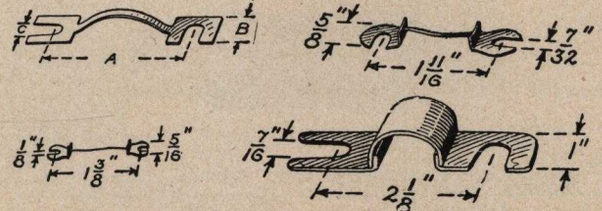
Prices and styles shown in catalogue No. 19.

Approved Dec. 12, 1904.

Chicago:
170 So. Clinton St.

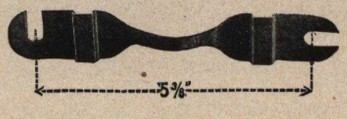
CHICAGO FUSE WIRE & MFG. CO.,

New York:
90 W. Broadway.



G. E. All styles. Approved Dec. 16, '04.

GENERAL ELECTRIC CO., Schenectady, N. Y.



Westinghouse, all styles. Approved Dec. 16, '04.
Also aluminum in special blocks.

WESTINGHOUSE ELEC. & MFG. CO., Pittsburg, Pa.

"Weber" Plug Fuses.

"Weber" Edison Plug Fuses, 0-30 A. 125 V., with mica caps. Furnished with solid brass caps on special order at one cent each additional list price.

In these fuses there is no lump of solder to prevent proper bottoming of plug in cutout. Neither the cap nor screw shell can turn or become loose. When fuse blows there is no possibility of the escape of molten fuse metal. The large vent holes provide for the proper escape of gas.

Made in 3, 6, 10, 12, 15, 20, 25 and 30 A. Std. pkg. 500. List price $0.07. Approved Aug. 28, '08.

HENRY D. SEARS, General Sales Agent,
131 State St., Boston, Mass.

Bryant Edison type, 125 V. Approved April 25, '05.

Also Non-Arcing Indicating Plug Fuse, Edison type, 10-30 A., 250 V., Cat. Nos. 329-340 incl. Approved June 10, '08. Also Standard type renewable, 0-30 A. and 31-60 A., 250 V. Approved April 13, '06.

BRYANT ELECTRIC CO., Bridgeport, Conn.

G. E. Renewable, for use with 1905 Standard Cartridge Fuses, 250 V. Cat. No. 36093, 0-30 A. Cat. No. 36094 31-60 A. Approved Sept, 26, '05.

G. E. 3-30 A., 125 V. Cat. Nos. 66327-66341. Porcelain bases, with brass and mica caps firmly spun into position on the base. Approved June 15, '07.

GENERAL ELECTRIC CO., Schnectady, N. Y.

"D. & W." Type C., Edison Filled. 0-30 A., 250 V.

Approved Aug. 14, '06.

D & W FUSE CO., Providence, R. I.

"Noark" Standard Type, renewable, 250 V., Cat. No. 2598, 0-30 A., and Cat. No. 2599, 31-60 A.

Approved June 5, '05.

H. W. JOHNS-MANVILLE CO., New York, N. Y.

"Electroduct" Enamel Finish Conduit For Interior Wiring

ELECTRODUCT is a mild, ductile steel, enamel finish conduit for interior wires. The grade of steel used in the manufacture of "ELECTRODUCT" is the highest obtainable. It is soft and possesses great flexibility; it can be easily cut and it bends without fracture.

The Cleaning of the pipe in preparation for the enameling process is done with extraordinary care. The grease, scale, rust and dirt with which all pipe is covered when received from the mill is thoroughly removed by a chemical process which leaves a perfectly clean metallic surface exposed.

The Enamel with which "ELECTRODUCT" is coated inside and out is noted for its quality. It is a specially compounded substance which possesses in an extremely high degree the peculiar qualities required in the manufacture of a reliable metallic conduit. It is absolutely unaffected by age, moisture, heat or cold, it withstands the action of acids or alkalies and it is so flexible that bending of the pipe will not cause it to chip or crack.

The Method of Applying the enamel in the manufacture of "ELECTRODUCT" is as follows: The metal tube is first made absolutely free from all foreign matter in order that the enamel may fill all the irregularities of the metallic surface. The enamel is then applied at a high temperature, a method which prevents the formation of air-films, and is baked for several hours. During a considerable part of this baking period the enamel remains in a semi fluid state, resulting in its forming a perfect contact with and absolute adhesion to the metal, as well as a complete obliteration of pores.

Approved Feb. 10, '06.

New York
Atlanta
San Francisco

AMERICAN CIRCULAR LOOM CO.,
Boston, Mass.

Chicago
New Orleans
London

"American" Rigid Steel Conduit for Electric Wiring

"American" conduit for interior wires is manufactured of a special, high grade soft steel tube coated inside and out with a flexible and decay-resisting enamel.

Preparation of Tube

Great attention is paid to cleaning the pipe. All scales, burrs, slivers, rust, grease, etc., are removed from the outside and inside of the tube. The process includes the use of the sand blast under United States patents. The surfaces having been prepared are then enameled.

The Enamel

The enamel used in the manufacture of "AMERICAN" conduit is a special compound and is warranted to withstand the action of acids or alkalies and to be unaffected by heat, cold or moisture. It is flexible and will not chip or fracture on bending the tube. It is thoroughly baked, forms a perfect union with the metal of the tube, is tough and firm and will stand rough usage.

The Tests

"AMERICAN" conduit is manufactured in accordance with the regulations of the Underwriters and is officially inspected and labeled before leaving the factory.

It is made in ten feet lengths and threaded at both ends. Coupling is furnished with pipe.

Complete stocks of "AMERICAN" conduit and fittings are carried in the company's warehouses in Chicago, New York and San Francisco, and shipments are promptly made.

Approved May 21, '06.

Factory: New Kensington, Pa.

THE AMERICAN CONDUIT MFG. CO.,
Keystone Bldg., Pittsburg, Pa.

New York
Gilpin, V. C. & Co.,
120 Liberty St.
(Local Stock)

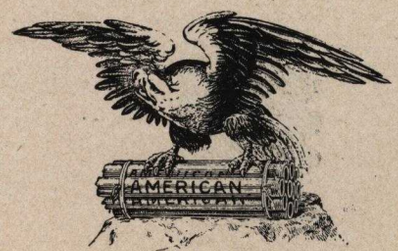
Chicago
Wm. P. Crockett Co.
269-271 S. Canal St.
(Local Stock)

San Francisco
Aylesworth Agencies Co.
Greenwood Bldg.
(Local Stock)

Baltimore
E. V. Murphy
226 East Pleasant St.

Philadelphia
L. P. Clark,
144 N. 12th St.

Birmingham
Southern Electric Sales Co.,
Brown-Marx Bldg.

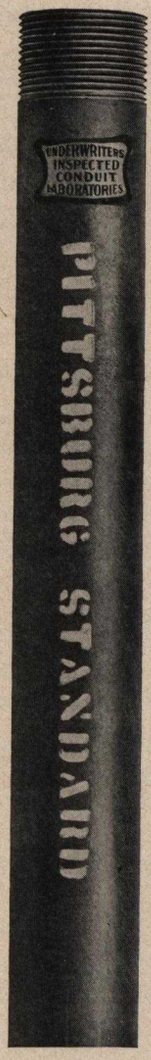


Patents Pending.

Pittsburg Standard Rigid Iron Enamel Conduit with Clean, Rust-Proof Threads

Photograph of Old Style Threads

Photograph of New Style Threads



The manufacturers of Pittsburg Standard Enameled Conduit lay the strongest emphasis on the following features of their product:

1. Perfectly clean, sharp threads at both ends. They apply a special, rust-preventing preparation, and guarantee the threads at both ends to be of standard gauge and just as clean and sharp as when they leave the threading machine.

2. The coating of the conduit is a specially prepared high-grade elastic enamel, proof against deterioration, and applied in such a manner as to produce a perfect enamel surface.

3. The conduit reaches the man on the job ready to be used, no necessity existing for scraping off enamel or running a die over the threads to clean them.

4. Pittsburg Standard conduit is made of the finest soft steel, heavy wall pipe manufactured. It can be bent as freely as may be necessary and without fracture or other injury.

It is thoroughly cleaned before the applying of the enamel and is perfectly smooth and even from end to end.

Approved. April 17, '06.

Manufactured by

ENAMELED METALS COMPANY,

Pittsburg, Pa.

Patents Pending.

ENAMELED STEEL PIPE
for
ELECTRIC WIRE CONDUIT

Inspected and Labeled
Under direction of the Underwriters' Laboratories.

Is guaranteed to pass the tests under any recognized, reasonable specification.

Every length of pipe is perfectly welded.

The pipe is thoroughly cleaned of burrs, scale and silicates and made perfectly clean and smooth before enameling.

The pipe is drawn, prepared and enameled by the manufacturers themselves.

Is made of the finest quality of steel and bends easily and without fracture.

All threads are cut to standard.

The enamel is elastic, bends without cracking, and is applied in two coats.

It is water- weather- acid- and alkali-proof and is non-corrosive under all conditions.

"NAVALITE" has a high reputation and is largely used.

All standard sizes of pipe, elbows and couplings are in stock and orders are filled quickly.

Special sizes furnished on short notice.

Approved June, 1905.

MARK MANUFACTURING COMPANY, Chicago, Ill.

Mills:
Zanesville, Ohio. **Evanston, Ill.**

"Economy" Rigid Conduit

ECONOMY CONDUIT is made under a special process from heavy wall mild steel of the highest grade obtainable.

It can be bent without any danger of cracking.

ECONOMY CONDUT is coated inside and outside with an indestructible and perfectly flexible enamel which resists acids and alkalies and will bend without breaking or flaking.

Extraordinary care is taken to remove all trace of burrs and scale and to produce a perfectly smooth and even interior.

ECONOMY CONDUIT strictly complies with the requirements of the Underwriters and is rigidly inspected and labeled in the factory by the official inspectors. It is guaranteed perfect in every particular.

All standard sizes are carried in stock and prompt shipments are assured. It is made in ten foot lengths with coupling on one end. Orders for special sizes promptly filled.

ECONOMY CONDUIT may be ordered from the company's branches at Boston (44 Federal St.); New York (253 Broadway); Chicago (88-90 W. Van Buren St.); St. Louis (539 Frisco Bldg.); San Francisco (620 Market St.) or the home office.
Approved Feburary 27, 1906.

NATIONAL METAL MOLDING CO.,

Fulton Bldg., Pittsburg, Pa.

Catalogue sent on request.

CONDUIT, RIGID and FLEXIBLE.—(Continued).

"Galvaduct," "Loricated" and "Sterling."

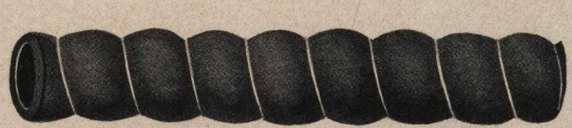
"GALVADUCT" Conduit is a high grade mild steel tube, of standard gas pipe dimensions, thoroughly cleaned of silicates, scales and burrs, and then galvanized by an exclusive and patented electro-chemical process. By this method of zincing an alloying and close adhesion of the iron of the tube and the zinc coating takes place, which permits of the bending, twisting or flattening of the conduit without causing any injury to the protective covering. There being a metallic zinc coating, with no insulating japan at the threads, good electrical contact at the joints is ensured. With "GALVADUCT" there is no japan at the joints to scrape off before installation and bonding is reduced to a minimum.

"GALVADUCT" is well and sharply threaded, is uniform in quality, and can be easily bent, cut or threaded on the work. This tube is patented, and the trade name registered in the U. S. Patent Office. Approved May, 1900.

"LORICATED" Conduit is manufactured exclusively by the Safety-Armorite Conduit Company. The name "Loricated" is registered in the U. S. Patent Office, and only the product of this company is entitled to the use of the name. As this Conduit is branded at the factory, users should see that each length bears this trade name.

"LORICATED" Conduit is made of soft, high grade steel that allows of bending without danger of fracture. It is enameled inside and outside with a special, flexible compound which is proof against acids and alkalies, and that bends without cracking or flaking, and is unaffected by heat or cold.

Cleaned by an effectual patented process, which positively removes all mill scale, silicates and other obstructions, and then enameled, the interior surface of "LORICATED" Conduit allows of ready insertion and extraction of wires without the use of soapstone or other lubricant. Approved January, 1898.



STERLING FLEXIBLE STEEL CONDUIT is made of a single strip of specially manufactured soft steel, under U. S. Letters Patent. The strip is well and uniformly galvanized, protecting the conduit against corrosion. Among its features are: Secure locking; proof against moisture; ease of cutting; economy and quickness of installation. It is made up in uniform coils of 50 and 100 feet (see corner cuts.) Approved November 30, 1904.

SAFETY-ARMORITE CONDUIT CO.,
Pittsburgh, Pa.

Greenfield Flexible Conduit.

Greenfield Flexible Steel Conduit possesses these qualities: It is constructed of rolled metal strips of steel, so formed that the inner and outer walls are smooth and free from burrs. The finish is *galvanized* on both the inside and outside surfaces, thus rendering the conduit, to the greatest degree, *rust proof*. These strips are wound spirally upon each other in such manner as to interlock their concave surfaces, and present their convex surfaces, both exterior and interior, thereby securing a smooth and comparatively frictionless surface inside and out.

Approved Nov. 30, '04. Also single Ribbon type. Approved April 26, '06.

Sprague Lined Conduit.

Iron-armored Insulating Conduit is a wrought iron pipe lined with the manufacturers' well-known asphaltic paper insulation. The thickness of the pipe is that of standard gas pipe. It is next to impossible to draw or force the insulating lining out of the pipe, as it is placed there under high pressure, filling up the interstices and thus leaving absolutely no air space between the insulation and the wall of the pipe.

The lining of the Iron-armored Insulating Conduit serves the double purpose of insulating the conductors from the surrounding metal and insulating the inner wall of the metal tube from the atmosphere.

Approved Nov. 30, '04.

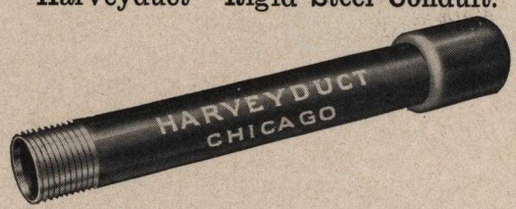
SPRAGUE ELECTRIC CO., New York, N. Y.

"Loricated" and "Galvaduct"

Approved April 27, '08.

CONDUITS COMPANY, LTD., Toronto, Ont., Canada.

"Harveyduct" Rigid Steel Conduit.



"HARVEYDUCT" is a superior unlined steel conduit. It is made from selected soft steel, bends easily and without injury to either the pipe or enamel.

All burrs, scale, silicates, etc. and thoroughly removed, thereby providing a perfectly clean base for the enamel.

"HARVEYDUCT" has two coats of special enamel. This enamel is extremely tough, though flexible, and does not check, flake or scale.

"HARVEYDUCT" is proof against rust, acids and alkalies, and passes all requirements of the National Board of Fire Underwriters.

"HARVEYDUCT" is made in two ways. Enamelled threads, as all ordinary conduit comes, or clean threads—the threading done after enamelling.

"HARVEYDUCT" is manufactured under most modern conditions in equipment and processes. Approved Feb. 7th, '07.

WESTERN CONDUIT & MFG. CO.

Factory: Harvey, Ill. **1110 Tacoma Bldg., Chicago, Ill.**

"Clifton"

Approved May 8, '06.

CLIFTON MFG. CO., Boston, Mass.

CONDUIT FIBRE

Approved for use when laid in concrete in central stations. Approved Aug. 28, '07.

FIBRE CONDUIT CO., Orangeburg, N. Y.

Bituminized Fibre Conduit.

Approved for use in central stations when laid with its entire length in concrete. Approved June 10, '08.

AMERICAN CONDUIT CO., Chicago, Ill.

Alphaduct.

ALPHADUCT FLEXIBLE CONDUIT TRADE MARK FOR WIRES ELECTRIC

ALPHADUCT possesses great flexibility due to its special construction and is successfully fished in difficult places.

The interior finish is of smooth, hard finished cotton duck, the characteristic WHITE INSIDE well lubricated with powdered soapstone to make it easy to draw in the wire.

The lower cut shows construction used to give protection from moisture.

It possesses a smooth interior, is extremely flexible, is not injured by bending, smashing or kinking and is flame proof to the extent that it will not convey fire when a flame is applied.

It does not become hard or brittle and cuts off clean so there is absolutely no waste.

LIST PRICE.

Size Inside Dia.	Feet in each Coil	Price per foot
¼ inch	250	$0.06
⅜ inch	250	.07
½ inch	200	.08
⅝ inch	200	.10
¾ inch	150	.12
1 inch	100	.16
1¼ inch	100	.20
1½ inch	odd lengths	.34

CONSTRUCTION:

Inner lining of heavy canvas. The "White Inside."

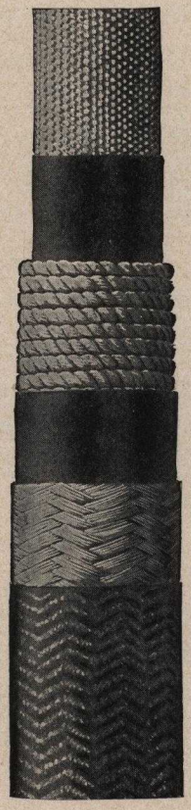
Water-proof Coating.

Hard Fibre Cord.

All interstices filled with special water-proof compound.

Outer Jacket.

Outer coating protection against moisture and abrasion.



Finished Conduit.

Manufacture Protected by Letters Patent.

Approved May 1, '06.

Discounts upon application.

ALPHADUCT CO., 136 Cator Ave., Jersey City, N. J.

"CIRCULAR LOOM."

"Circular Loom" is a flexible conduit for electric wires.

It is perfectly flexible and readily permits of the many bendings and turnings necessary in installation.

It is tough, strong and springy and does not collapse, thus insuring protection for the wires.

It fishes easily—every installing electrician appreciates the necessity of this feature.

It is moisture-proof and does not carry fire.

It is not affected by climatic conditions.

The interior of the tube is perfectly smooth—wires do not stick.

Reference to the accompanying cut will show the structure of "Circular Loom."

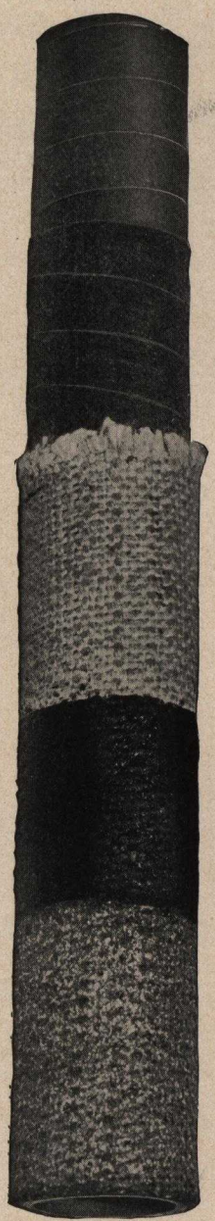
First is the inside tube, made of strong, tough, springy fibre specially manufactured for "Circular Loom" and designed to withstand the hard usage that flexible conduit frequently receives on the job by workmen treading on it, rolling wheelbarrows over it, etc.

Next comes a winding of moisture-proof rubber tape made specially for this purpose and of high quality.

Outside the rubber tape comes the woven tube. This is a heavy closely-woven cotton fabric adding greatly to the strength of the conduit and absolutely preventing elongation. Severe tests have shown that Circular Loom cannot be stretched to any appreciable extent.

Then comes the compound with which the woven covering is treated. It is a moisture-repellant, specially made for Circular Loom and by a process of boiling under pressure is forced into the minutest part of the woven covering, thereby affording a high degree of protection and insulation.

Finally, the outer covering is treated with powdered mica.



Approved Nov. 21, '04.

AMERICAN CIRCULAR LOOM CO., Boston, Mass.

New York, Atlanta, Chicago, New Orleans, San Francisco, London

FLEXDUCT

A Flexible Non-metallic Conduit for Interior Wiring

The special features of this conduit are:

Great flexibility;

Smooth and indestructible interior;

Tough, springy damage-proof exterior;

High insulation and moisture proof qualities;

Absolute inseparableness of the different parts of which it is composed—each part is closely knit into the other.

Construction.

Outer covering of tough, strong, woven material, moisture-proof and incapable of stretching.

Spiral of fibre interwoven with warp, the warp passing over and under the spiral alternately.

Perfectly smooth interior, on which wires cannot catch.

This interior is an inseparable part of the conduit and cannot be loosened or ripped out.

FLEXDUCT has been on the market a number of years and has gained a high reputation in the construction field. The method of manufacture and the rigid factory inspection ensures uniformity in internal diameter, smoothness of raceway and thorough insulation and treatment of the exterior of every length.

NATIONAL METAL MOLDING CO.,
Pittsburgh, Pa.

Branches:

New York, Postal Telegraph Bldg.
Boston, 44 Federal Street
Chicago, 88-90 W. Van Buren Street
St. Louis, 539 Frisco Bldg.

Branches:

Salt Lake City, Walker's Bank Bldg.
San Francisco, Crocker Bldg.
Los Angeles, Pacific Electrical Bldg.
Seattle, Alaska Bldg.

Paris, France, 85 Rue St. Lazare
London England, 44-46 Whitfield St., Tottenham Court Road

Greenfield

Flexible Steel Armored Conductors.

Twin Conductors Type BX

Greenfield Flexible Steel-armored Conductors (sometimes called in the trade BX Cable) have introduced a simple but effective method of wiring, and taken a leap into popularity because of the ease and perfection of installation. These Conductors afford ample protection against mechanical injury. They can be easily drawn or fished into a building between partitions and under floors, in which case, fastenings are required only at the outlets. Conductors so installed can be removed as easily as wires could be drawn from a conduit.

Twin Conductors Type BXL

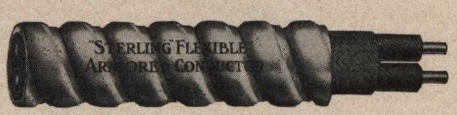
BXL Conductors are encased in lead beneath the steel armor for the purpose of protecting the insulation of the conductors from moisture. For wiring in breweries and packing houses, and for certain classes of underground and sub-marine wiring, the lead covered Steel-armored Conductors are superior to any other material.

Chicago
Milwaukee
Boston
Baltimore
Philadelphia

SPRAGUE ELECTRIC COMPANY,
General Offices: 527-531 West 34th Street,
New York City.

Pittsburg
Atlanta
New Orleans
San Francisco
Seattle

"Sterling Flexible Armored Conductor.



"STERLING" FLEXIBLE ARMORED CONDUCTOR. This product is made of a high quality, thoroughly tested, insulated wire, armored with tightly locked single strip, galvanized steel covering. The armor can be easily and quickly stripped from the wire without injury to the insulation by means of a new and improved stripping tool, specially manfactured by the Safety Armorite Co. for this purpose, and patented by them.

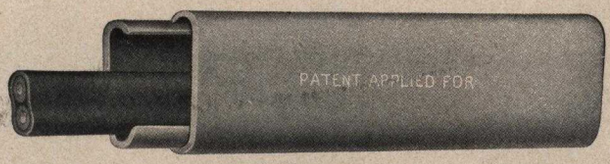
After stripping, the armor is left with a clean, square shoulder, without burr.

Approved April 3, '07.

SAFETY-ARMORITE CONDUIT CO.,
Pittsburg, Pa.

MOLDING, METAL.

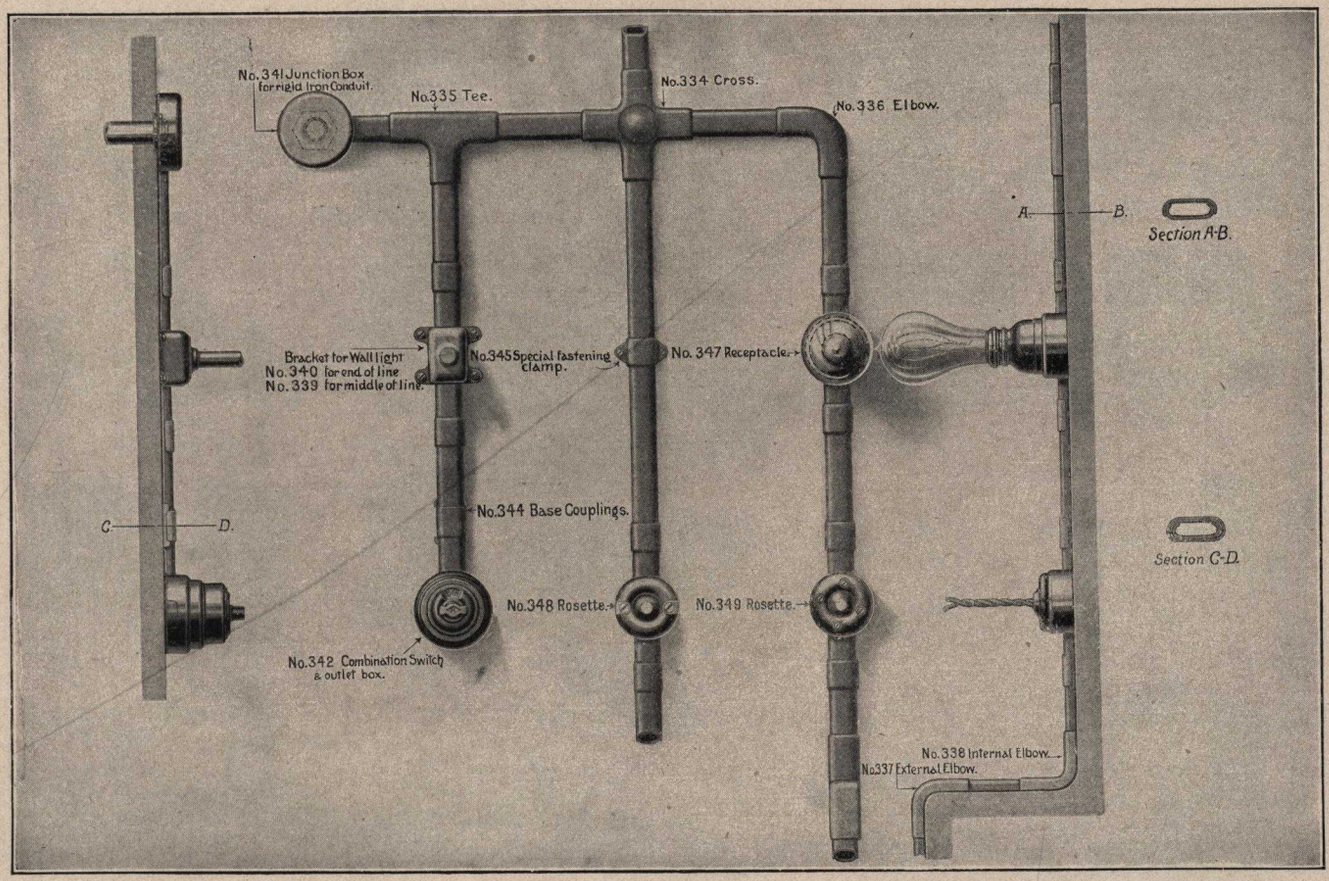
"National" Metal Molding



Molding Assembled.

Base
Furnished in lengths of 8 ft. 4 inch.

Capping.
Galvanized by the patented process of "Sherardizing."



Sample installation, showing the application of fittings

An effective substitute for the old-fashioned and, in many respects, objectionable wooden molding. Perfectly fire-proof, easy of installation, labor-saving, and makes a first class job. Consists of but two parts, a base and capping, the former furnished with countersunk holes for the reception of screws or bolts to secure it to wall or ceiling. The cap is "snapped" on after the base and fittings are installed and wire laid in. The wires are readily accessible at all times. A very comprehensive line of fittings has been designed by the manufacturers to meet all condition of installation. Send for catalog.

Approved Sept. 10, '07.

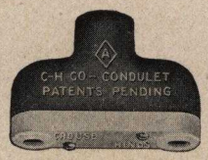
NATIONAL METAL MOLDING CO., Fulton Building, Pittsburgh, Pa.

Branchs:

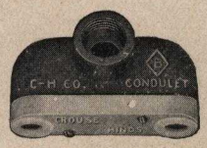
Paris, France, 85 Rue St. Lazare
London, England, 44-46 Whitfield St., Tottenham Court Road
Salt Lake City, Walker's Bank Bldg.
San Francisco, Crocker Bldg.
Los Angeles, Pacific Electrical Bldg.
Seattle, Alaska Bldg.
New York, Postal Telegraph Bldg.
Boston, 44 Federal Street
Chicago, 88-90 W. Van Buren Street
St. Louis, 539 Frisco Bldg.

CONDUIT BOXES FOR EXPOSED WORK.

"Condulets."

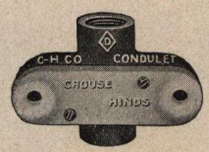


Type A-12.



Type B-12

Type C-11

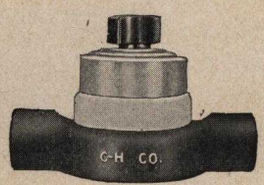


Type D-12

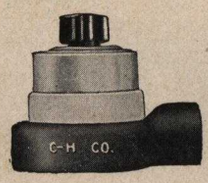
Type 1-E-13

Type F-12

Type T. P-1



Type G-151*

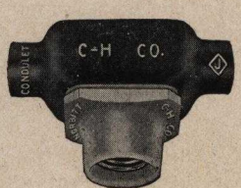


Type H-15

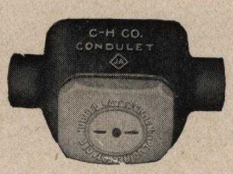
Type H-15-A

Type G-1511

Type H-155

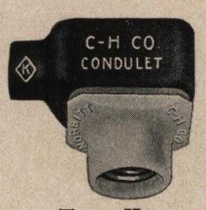


Type J-1227*



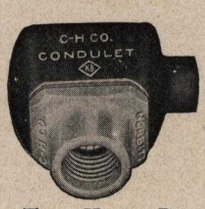
Type J-115-A

Type J-11338-B



Type K-1227

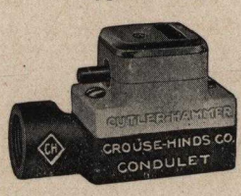
Type K-1227-A



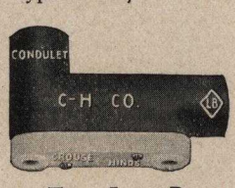
Type K-1227-B

Type K-1227-D

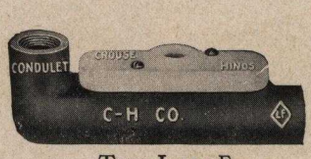
Type K-1227-C



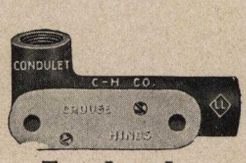
Type C. H-1



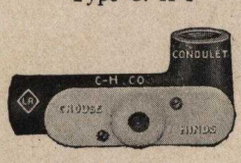
Type L-112-B



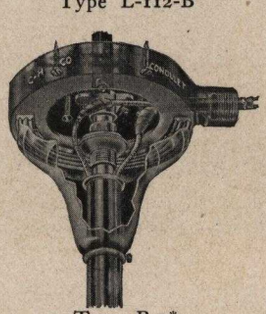
Type L-111-F



Type L-112-L

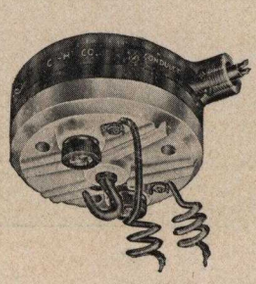


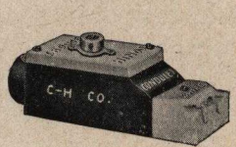
Type L-111-R


Type P-1*

Type P-11-C

Type P-1-A

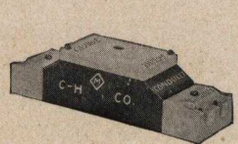

Type R-1*



Type O-10210

Type R-11-C

Type R-1-A



Type M-221

*Also made in L, T and X forms.

"Condulets," all types and sizes for conduits ½ in. to 3 in. inclusive. Approved Aug. 14, '07.

CROUSE-HINDS CO., Syracuse, N. Y.

(Continued on next page.)

CONDUIT BOXES FOR EXPOSED WORK.—(Continued).

"Condulets."

Type QH-1510-A

Type QH-1510-B

Type QH-11510-C

Type QH-1151-L

Type QH-111510-T

Type QK-1510-A

Type QK-15101-B

Type QK-11510-C

Type QK-11510-L

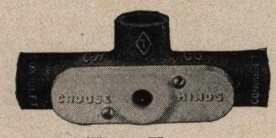
Type QK-111510-T

Type N-1000*

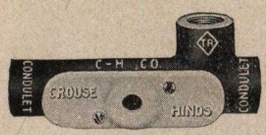
Type N-11000-C

Type W-10*

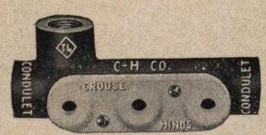
Type W-110-C



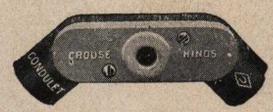
Type T-1111



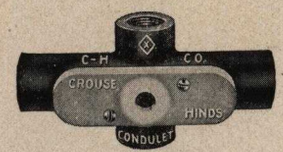
Type T-1111-R



Type T-1113-L

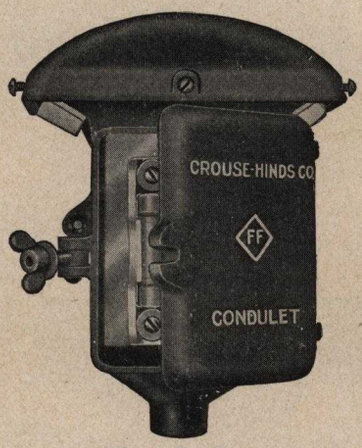


Type U-111



Type X-11111

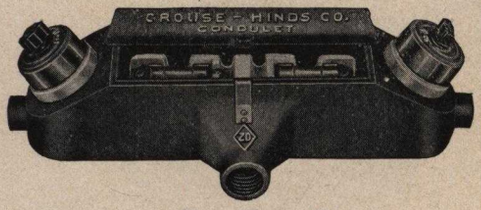
Type V-189* Type V-1189-C Type V-189-A



Type F. F-13022

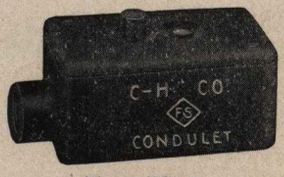
Type S-100*

Type S-1100-C

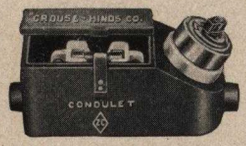


Type Z-1115-D

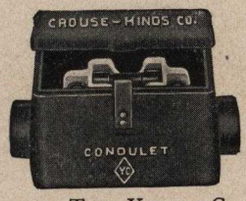
Type Y-111302-D



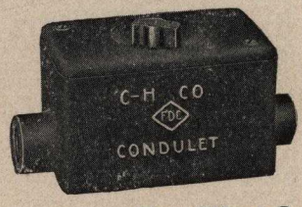
Type FS-18



Type Z-115-C



Type Y-11302-C



Type FD-118-C

*Also made in L, T and X forms.

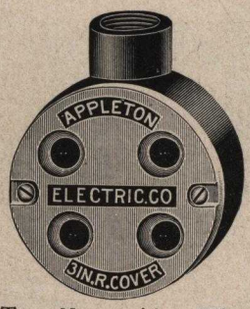
"Condulets," all types and sizes for conduits ½ in. to 3 in. inclusive. Approved Aug. 14, '07.

CROUSE-HINDS CO., Syracuse, N. Y.

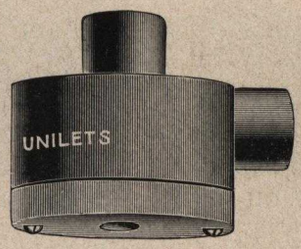
CONDUIT BOXES FOR EXPOSED WORK.—(Continued).

"Unilets."

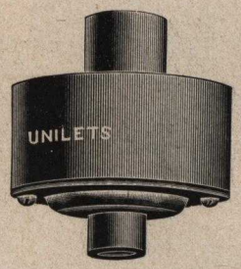
Type No. 14—Showing 3 Porcelain Bushings.



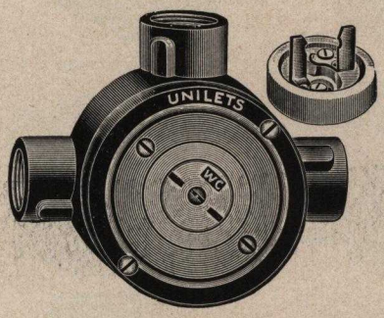
Type No. 1 with 4 Wire. Porcelain Cover.



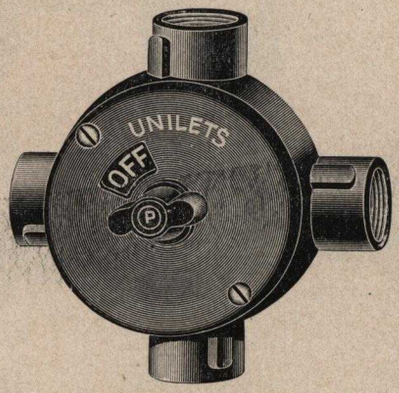
Type No. 7 with 1 Wire Porcelain Cover.



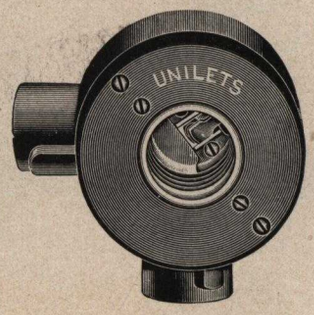
Type No. 6 with Metal Nipple Cover.



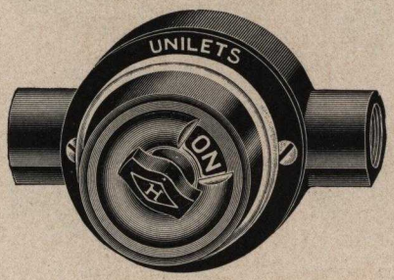
Type No. 3 with Hubbell Floor Receptacle.



Type No. 4 with Flush Snap Switch and Cover.

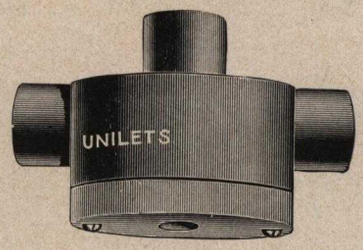


Type No. 5 with Receptacle and Cover.

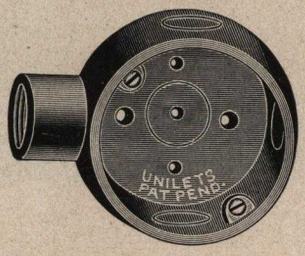


Type No. 2 with Snap Switch.

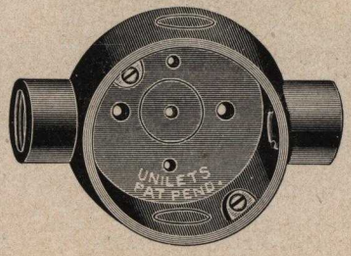
No. 2 with P. & S. Receptacle and Cover.



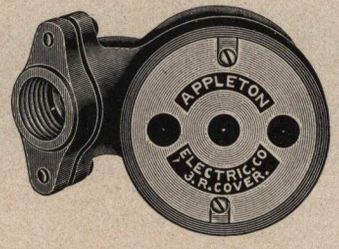
Type No. 8 with 1 Wire Porcelain Civer.



Type No. 1 Steel.



Type No. 2 Steel



N. 12 Service Entrance with 3-wire Porcelain Cover.

"Unilets" Cast Iron and Steel Outlet Boxes, with threaded openings for ½ to 3 inch rigid conduit. With covers of stamped steel or porcelain or with porcelain bushings.

Covers are interchangeable with different types and styles of outlets, thus permitting a minimum stock to be carried.

They are designed with ample room to make and tape joints without kinking or injuring the wire.

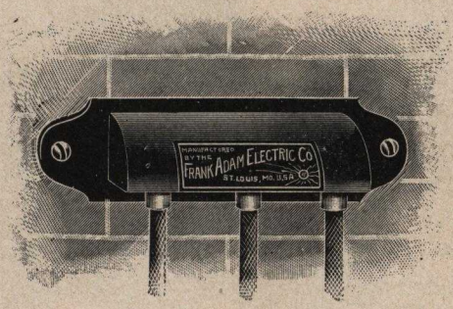
Approved April 13, '08.

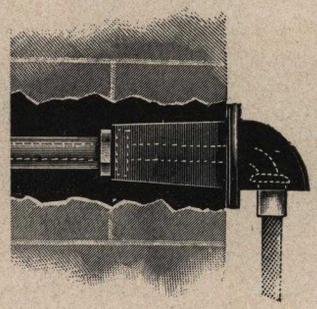
APPLETON ELECTRIC CO.

Chicago
52-54 N. Jefferson St.

New York
227 Fulton St.

"FA" Service Entrance Boxes.

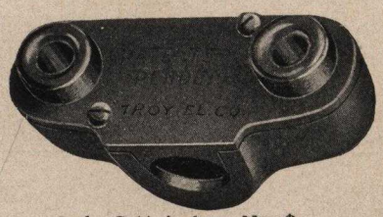




"FA" Service Entrance Box. This Box is made of cast iron and finished in baked Japan enamel. The small size when installed will fill the space of one standard size brick. The large size fills the space of two bricks high and 1½ wide. Small size will take one pipe of ½ in., ¾ in. or 1 in. iron conduit, or three ½ in., or two ¾ in. porcelain tubes through back. Large size will take one pipe of 1½ in., 2 in., or 2½ in. iron conduit, or three 1¼ in., or two 1½ in. porcelain tubes. Approved June 18, '06.

FRANK ADAM ELECTRIC CO., St. Louis, Mo.

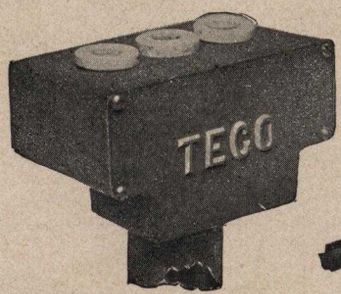
"Teco" Conduit Boxes



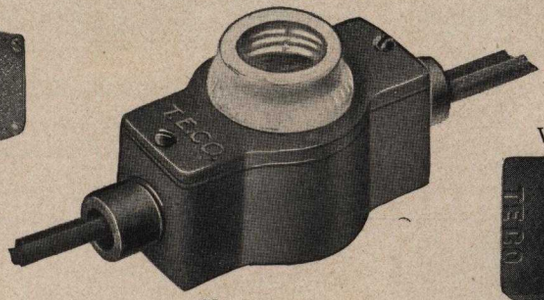
Style C-½ inch. Net $0.14.

Entrance Cap No. 1
½ inch. Net. $0.24.

Style S. ½ inch.
Without Switch. Net. $0.22.



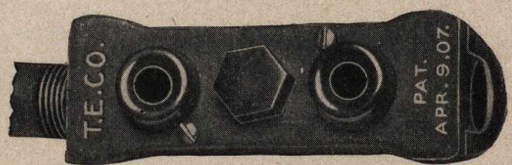
Style D. ½ inch. Net. $0.12



No. 1520.
Complete without Lamp. Net. $0.40.

Style L. ½ inch. Net.

Style T. ½ inch. Net. $0.25.



Style A. ½ inch. Net. $0.16.

Style X. ½ inch. Net. $0.28.

"Teco" Conduit Fittings, one, two and three wire, with porcelain or composition bushings. Styles A, B, C, D (for Motor Work), L, S, T, and X. Styles A, T and X are interchangeable without disturbing the conduit. All threads for composition bushings are for ⅜" iron pipe. Lock nuts and bushings furnished with each type. Std. Pkg. 25 to 100.

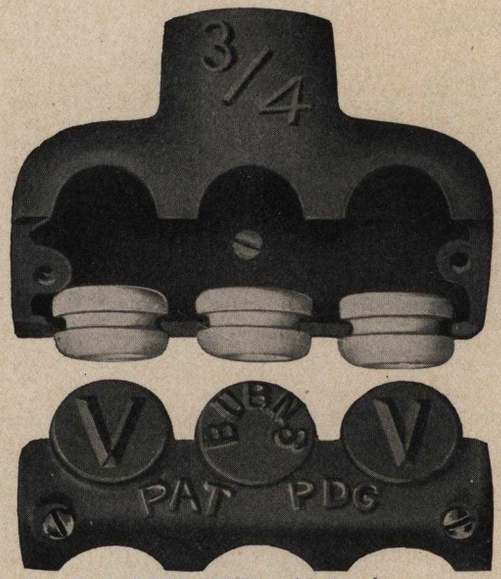
Above are net trade prices. List prices and discounts furnished on request.

Entrance Caps and Style D made up to 3 inches, all other styles ½ and ¾ inch only.

Approved Aug. 28, '07.

TROY ELECTRICAL CO., Troy, N. Y.

CONDUIT BOXES FOR EXPOSED WORK.—(Continued).

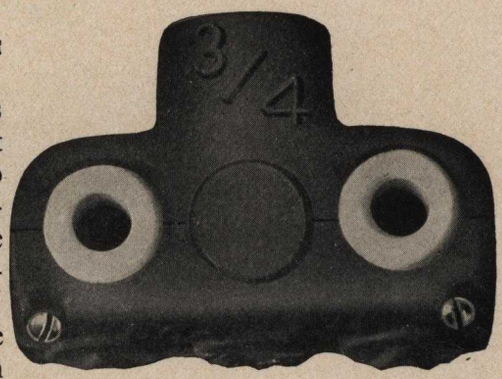


Standard TYPE ONE, with 3-wire cover removed. Showing bushings in line with conduit.

"V. V." Fittings

These fittings are made of cast iron, threaded to receive the conduit, and are heavily enamelled jet black.

The outlets are bushed with heavy glazed porcelain bushings, held securely in place by the removable plate, with no strain on the porcelain. When the bushing plate is removed two sides of these fittings are open, giving ample room for wiring and splicing.



Standard TYPE ONE with bushings at right angles to conduit.

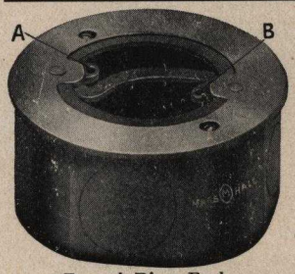
Type ONE is furnished with a reversible bushing plate allowing the wires to come out in line with OR at right angles to the conduit.

"V. V." Fittings are made in all conduit sizes from ½in. to 3 in. inclusive. The ½ in. size is furnished with one, two or three outlets, the ¾ in. size with one, two, three or four outlets, and the 1 in. and larger sizes are furnished with one, two, three, four or five outlets.

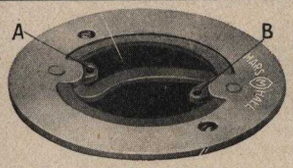
Send for catalogue describing "V. V." Fittings.

Approved March 31, 1908. Patented June 30, 1908.

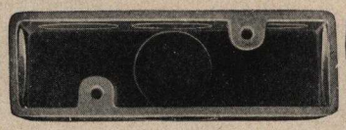
JAS. F. BURNS, 47 N. Hutchinson St., Philadelphia, Pa.



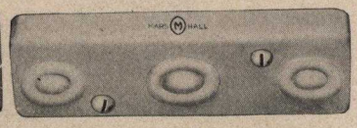
Round Pipe End.



Universal Metal Cover for Round Boxes.



Rectangular Pipe End.



Porcelain Cover, 1, 2 or 3 Wire.

"Pipe End" Fittings with steel or porcelain covers, for exposed work only. Approved July 13, '08.

MARSHALL ELECTRIC MFG. CO., Boston, Mass.

"Pipe Taplets." Cast iron outlet boxes with threaded openings for standard sizes or rigid conduit. For use with special porcelain covers or with suitable approved rosettes or receptacles.

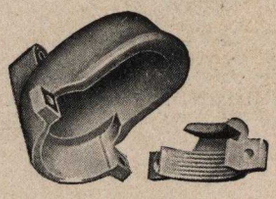
Approved Oct. 12, '08.

H. T. PAISTE CO., Philadelphia, Pa.

"Boss" Weatherproof Entrance Bushing, 2 and 3 wire. Approved June 28, '05.

½ in. and ¾ in., std. pkg. 50; 1 in., 1¼ in. and 1½ in., std. pkg. 30; 2 in., 2½ in. and 3 in. std. pkg. 10.

ELEC. SPECIALTY MFG. CO., Providence, R. I.



Conduit Outlet Cap. A cast metal cap for outdoor use at service entrances. Approved for service entrances only.

Approved July 5, '07.

½ in. and ¾ in., std. pkg. 50; 1 in., 1¼ in. and 1½ in. std. pkg. 30; 2 in., 2½ in. and 3 in. std. pkg. 10; 3½ in., 4 in. and 6 in., std. pkg. 5.

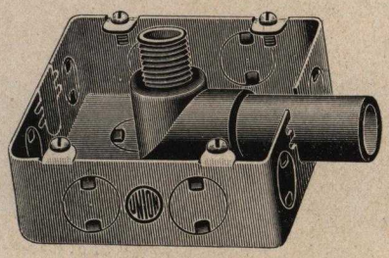
GILLETTE-VIBBER CO., New London, Conn.

"Fox" Terminal Hood. A cast iron plate and cover for service entrance, 2 and 3 wire. Approved April 9, '07.

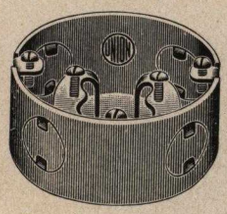
Approved for use at service entrance only. ½ in., ¾ in. std. pkg. 50; 1 in., 1¼ in., 1½ in. std. pkg. 25; 2 in., 2½ in., 3 in. std. pkg. 10.

FOX MANUFACTURING CO., Milwaukee, Wis.

"Union" Outlet Boxes and Covers.

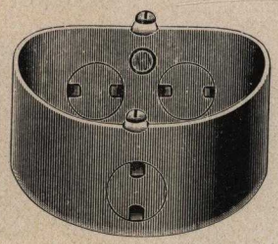


No. 101.



No. 107.

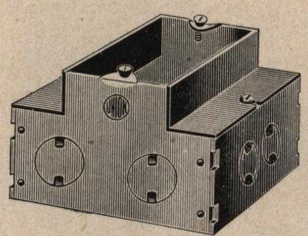
No. 103 with cover.



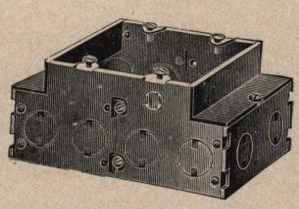
No. 112

Catalogue No.	DESCRIPTION	Price Each
101	Box—4-in. square, 1⅝-in. deep, a gas outlet in two sides	$0.20
101-A	Cover—Open Cover	.08
101-B	Cover—Closed Cover	.08
102	Box—4-in. square, 1⅝-in. deep	.20
102-A	Cover—Open Cover	.08
102-B	Cover—Closed Cover	.08
102-C	Cover—Closed Cover, with ⅜-in. Bushing	.12
102-D	Cover—Deep Cover, for Stand. Push Button or Rec. Switches	.08
102-E	Cover—Shallow Cover for Stand. Push Button or Rec. Switches	.08
102-F	Cover—Flat Steel Cover	.06
102-G	Cover—Cover for 2-Push Button Switches	.16
102-H	Cover—Cover for Hart Round Base Rotary Switch	.08
102-I	Cover—Cover for Perkins Round Base Rotary Switch	.08
103	Box—4-in. diam., 1⅝-in. deep	.20
103-A	Cover—Open Cover	.06
103-B	Cover—Closed Cover	.06
103-C	Cover—Closed Cover with ⅜-in. Bushing	.12
103-D	Cover—Flat Steel Cover	.06
103-E	Cover—Flat Steel Cover drilled for Stand. 10-amp. R. S. Switch	.10
103-F	Cover—Polished Brass Cover, flush, for Federal Sockets	.29
103-G	Cover—Polished Brass Cover, lapped, for Federal Sockets	.29
103-H	Cover—Steel Cover, flush	.06
104	Box—4-in. diam., 2¼-in. deep	.32
105	Box—4-in. diam., 1⅝-in. deep	.20
105-A	Cover—Cover for Norbitt Rosette	.06
105-B	Cover—Cover for Trumbull Receptacle	.06
105-C	Cover—Cover for C. 227 Norbitt Recep. & P. & S. 877, 988, 577	.06
105-D	Cover—Brass Cover for Norbitt Receptacle	.32
105-E	Cover—Brass Cover for Norbitt Receptacle & P. & S. 877, 988, 577	.32
105-F	Cover—Brass Cover for Trumbull Receptacle	.39
105-G	Cover—Brass Cover for G. E. Receptacle 9397	.32
105-H	Cover—Brass Cover for P. & S. Receptacle 777 & 977	.32
105-I	Cover—Steel Cover for P. & S. Receptacle 777 & 977	.06
155	Box—Single Conduit Switch Box without need of cover	.40
160	Box—Two Gang Conduit Switch Box without need of cover	.60
160	Spacer for Conduit Switch Box without need of cover	.26

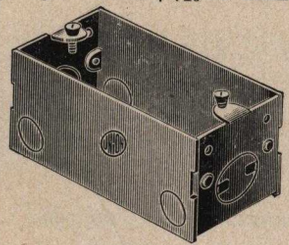
Catalogue No.	DESCRIPTION	Price Each
170	Box—Single Shallow Comb Conduit and Loom Box, 1⅞-in. deep	.20
170	Box—2-Gang Shallow Comb. Conduit and Loom Box, 1⅞-in. deep	.38
170	Spacer for Shallow Comb. Conduit and Loom Box, 1⅞-in. deep	.18
106	Box—3¼-in. diameter, round, 1⅝-in. deep	$0.20
106-A	Cover—Open Steel Cover	.06
106-B	Cover—Closed Steel Cover	.06
106-C	Cover—Closed Steel Cover with ⅜-in. Bushing	.12
106-D	Cover—Cover for Bryant Plug Recept. No. 1508	.08
106-E	Cover—Polished Brass Cover flush for G. E. Recep. No. 9397	.25
106-F	Cover—Polished Brass lapped	.27
106-G	Cover—Steel Cover flush for G. E. No. 9397	.06
106-H	Cover—Steel Cover lapped for G. E. No. 9397	.06
106-I	Cover—Steel Cover for P. & S. Recept. No. 777 and 977	.06
106-J	Cover—Brass Cover for P. & S. Recept. No. 777 and 977	.25
106-K	Cover—Polished Flush Brass Cover for Federal Socket	.25
106-L	Cover—Steel Cover Flush for Federal Socket	.06
106-M	Cover—Flat Steel Cover, drilled for Stan'd 5 Amp. R. S. Switch	.10
106-N	Cover—Polished Brass Cover, lapped for Federal Socket	.27
106-O	Cover—Steel for Benjamin Recept. No. 6 and 6 S	.06
107	Box—3¼-in. Diameter, Round, 1⅝-in. deep	.22½
107-A	Cover—Lapped Steel Cover for G. E. Recept. 50746, Bryant 5050	.06
107-B	Cover—Flush Steel Cover for G. E. Recept. 50746, Bryant 5050	.06
107-C	Cover—Flush Brass Cover for G. E. Recept. 50746, Bryant 5050	.27
107-D	Cover—Lapped Brass Cover for G. E. Recept. 50746, Bryant 5050	.27
108	Box—Ceiling Box, 4-in. diameter, ¾-in. deep	.09
109	Box—Ceiling Box, 4-in. diameter, ½-in. deep	.09
110	Box—4 11/16-in. square, 1⅝-in. deep	.28
110-A	Cover—Open Cover	.10
110-B	Cover—Closed Cover	.10
110-C	Cover—Closed Cover with ⅜-in. Bushing	.14
111	Box—4 11/16-in. square, 2¼-in. deep	.32
111-D	Cover—Open Lapped Cover	.11
111-E	Cover—Closed Lapped Cover	.11
112	Box—Bracket Box, 3 15/16-in. diameter, 2-in. deep.	.20
112-A	Cover—Open Cover	.06
112-B	Cover—Closed Cover	.06
120	Box—4-in. diameter, 1⅝-in. deep	.40
130	Box—4-in. diameter, 2¼-in. deep	.52
140	Box..4 11/16-in. diameter, 1⅝-in deep	.46
150	Box..4 11/16-in. diameter, 2¼-in. deep	.58



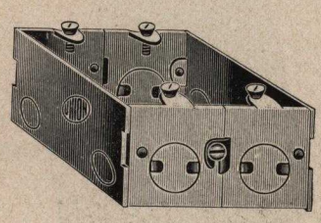
No. 155



No. 160



No. 170

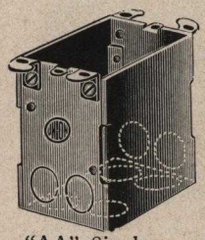


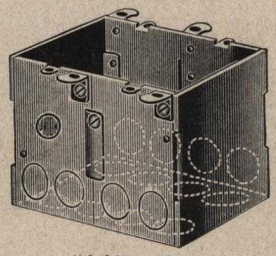
No. 170 2-Gang

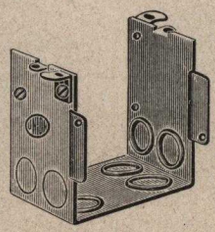
Approved June 22, '08.

CHICAGO FUSE WIRE & MFG. CO., 170 S. Clinton St., Chicago, Ill.

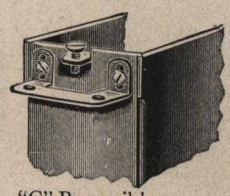
"Union" Sectional Switch Boxes.
For Old or New Work. Takes all Makes of Switches and Receptacles

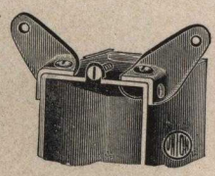

"AA" Single


"AA" 2 Gang.


"AA" Spacer

Patented April 2, 1907.


"C" Reversible ear furnished only when specified.


S. F. Ear Furnished only when specified.

Made in the Following Depths:

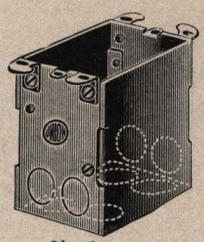
Type "AA" 3 in. Suitable for Standard partitions; Type "AB" 2¾-in. Suitable for standard partitions; Type "CC" 2½-in. Specially adapted for thin partitions; Type "CCS" 2 in. Takes New Cutter, "Arrow E," "Perkins," "H. & H.," M. & M. and all other makes; Type "RC" 2½ in. For Round Cup Switches; Type "BB" 3½ in. For Iron Conduit. All made from 14 Gauge Steel finished in Black Enamel.

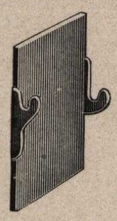
Many Contractors prefer to buy the 2 Gang Box already assembled, and to build up into higher Gangs, by inserting Spacers, as they have done in the past, thus avoiding the expense of making up a 2 Gang Box from a Single and Spacer, the price being the same in both cases.

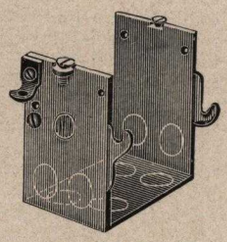
Where Contractors prefer to build up from the Single Box, the manufacturer will continue to furnish WHEN SPECIFIED, as has been his custom in the past, the Single Box with one side removable which permits the Spacers to be inserted, to make any number of Gangs desired.

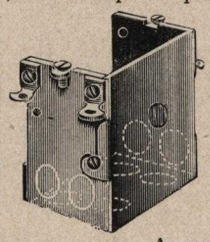
The Boxes carry the well known "Trade Mark," which stands for *Uniformity, Accuracy, Reliability.*

LIST PRICES: Single 50c, 2 Gang Box 90c, Spacers 40c, with clamps 10c per unit extra.

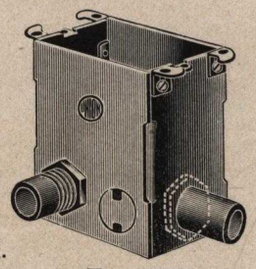

Single with removable end.



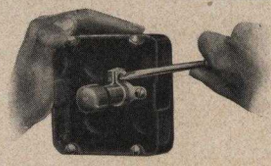

Showing how Spacer can be inserted


Approved Oct. 31, 1905.

For Flexible and Iron Conduit.


Type "BB"

CHICAGO FUSE WIRE & MFG. CO., 170 S. Clinton St., Chicago, Ill.

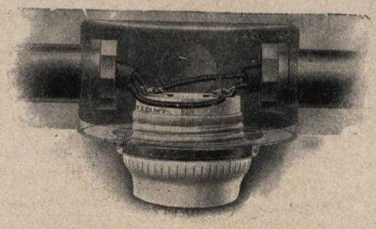


Federal Outlet Box Clamp.

The above cuts show the method of attaching the No. 900 Outlet Box Clamp. A device for attaching ceiling outlet boxes firmly to the dummy or gas pipe.

Designed to save time in attaching and to close up the open space around the gas pipe.

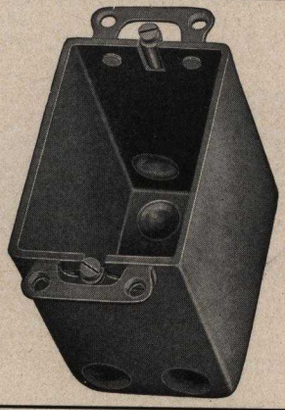
Approved Aug. 29, '08.



Federal Outlet Box Covers. Three and four inch brass and steel covers. Both lined and unlined.

Approved Apr. 2, '06.

FEDERAL ELECTRIC CO., Lake & Desplaines Sts., Chicago, Iil.



G. E. for Knob and Tube Work.
Cat. No. 37645.

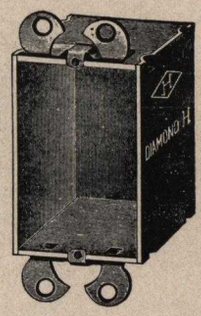
Approved Aug. 21, '05.

GENERAL ELECTRIC CO., Schenectady, N. Y.

"Diamond H." For push button and rotary flush switches. Made for from one to ten switches.

Approved June 15, '05.

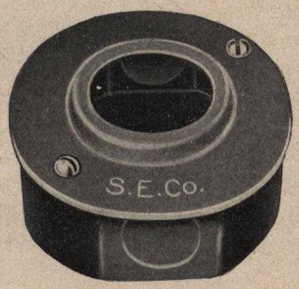
HART MFG. CO., Hartford, Conn.



"S. E. Co." Conduit and Switch Boxes

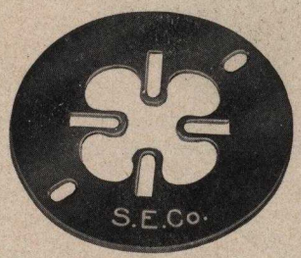
No. 6250—Sprague Octagon Box

Stamped Steel Knockout—Flat Sides—Rounded Corners



No. 6250
Octagon Box with G. E. Receptacle Cover

Nos. 6272 to 6275
Pendant Cover with Insulated Bushing.



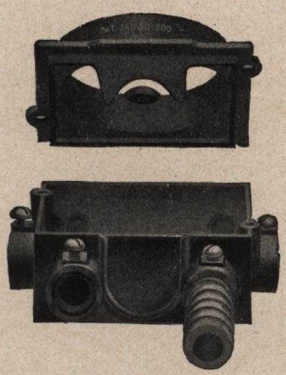
No. 6263
Snap Switch Cover.

Box No. 6250 is very convenient, because of its adaptability. It is practical and popular. It remedies the partial contacts between bushings or locknuts and curved surfaces, and provides absolute securance and substantial metallic continuity. This box has a full line of standard covers which are interchangeable with standard 3¼ inch round boxes.

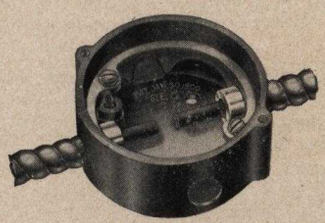
No. 6200 Square Box with No. 6201 Cover.

No. 6200 Sprague Square Outlet and Switch Box —Stamped Steel Knockout

These boxes and covers are thoroughly galvanized or neatly japanned. The box and covers are interchangeable with standard 4″ square boxes and covers.



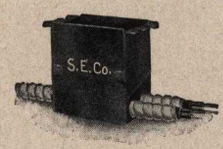
No. 5211 Type HX Sidewall Box. This box is made for ½ inch Flexible Steel Conduit. No. 5212 is similar to No. 5211 except that the former is provided with bushed outlets, suitable for No. 14 and No. 12 BX Armored Conductors. Plugs are furnished for unused outlets.



No. 1904 Outlet Box for Finished Building work.
No. 1904, four outlets, for No. 14 or No. 12 Type BX Conductors.

No. 5225 Type N Outlet Box for ½" Flexible Steel Conduit.

No. 5220 Type N Outlet Box.



No. 5991
Switch Box for No. 12 or No. 14 BX Conductors for finished buildings.

The above represents only a few of the various boxes and covers.

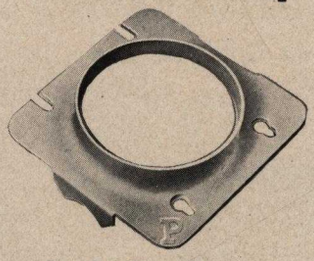
SPRAGUE ELECTRIC COMPANY

General Offices: 527-531 West 34th Street, New York City

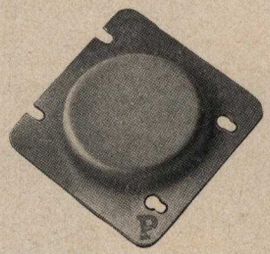
Branch Offices.
Chicago, Boston, Baltimore, Philadelphia, Pittsburg, Atlanta, New Orleans, San Francisco, Seattle.

Pratt Chuck Galvanized Stamped Steel Outlet Boxes and Covers.

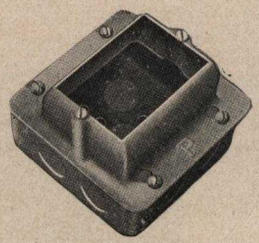
No. A. Box for combination gas and electric fixtures.



No. B. Open Covers.

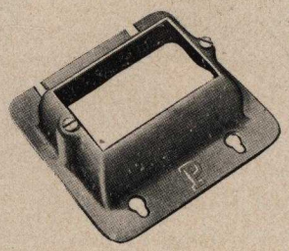


No. BC. Closed Cover.

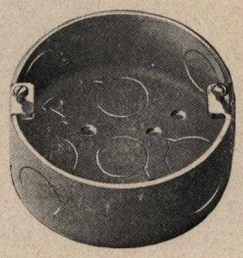


No. BA. Box.

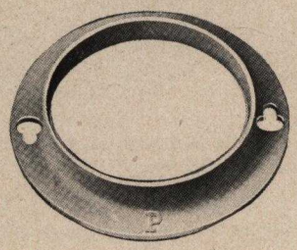
No. BH. Cover. For 2 push button switches.



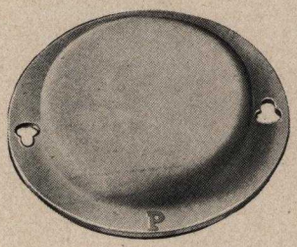
No. BG. Cover. Shallow Cover for Standard Push Button or Rectangular Base switches or Flush Plug Receptacles.



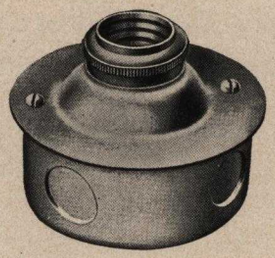
No. CA. Outlet and Junction Box.



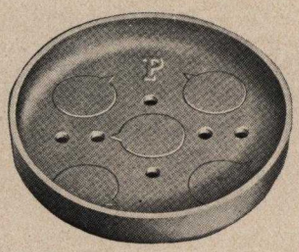
No. CB. Open Cover.



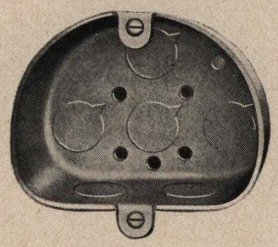
No. CC. Closed Cover.



No. EA. Box for Receptacles.



Nos. HA, IA and KA. Box for ceiling outlets in Terra Cotta.



No. LA. Bracket Outlet and Junction Box.

Dimensions and Descriptions and Prices covering all types of "Pratt Chuck" Outlet Boxes and Covers.

No. A. Box for Combination Gas and Electric Fixtures.

DIMENSIONS—Four inches square, 1⅝ inches deep.
OUTLETS—Eight conduit outlets in sides and five in bottom. For ½-inch or ¾-inch conduit only.
GAS OUTLETS—One in two opposite sides for ½-inch gas pipe only.

	Price per hundred
No. A Box	$20.00
No. B Open Cover or No. C Closed Cover	8.00

No. DA Deep Outlet and Junction Box for Lath and Plaster.

DIMENSIONS—Four inches diameter, 2¼ inches deep.
OUTLETS—Four outlets in sides and five in bottom. For ½-inch, ¾-inch and 1-inch conduit.
COVERS—Same as used with No. CA.

	Price per hundred
No. DA Box	$32.00

NOTE—No bottom outlets are provided in boxes arranged for 1-inch conduit.

No. EA Box for G. E. Receptacle No. 50746 Bryant Receptacle No. 5050.

DIMENSIONS—3¼ inches diameter, 1⅝ inches deep.
OUTLETS—Four outlets in sides. For ½-inch conduit only.

	Price per hundred
No. EA Receptacle box	$22.50
No. EB Flush Brass Cover; No. EC Lapped Brass Cover (see EA box)	27.00
No. ED Flush Steel Cover; No. EE Lapped Steel Cover	6.00

NOTE—Box cannot be furnished with bottom outlets.

No. FA Receptacle Box.

DIMENSIONS—3¼ inches diameter, 1⅝ inches deep.
OUTLETS—Four outlets in sides, one in bottom. For ½-inch conduit only.

	Price per hundred
No. FA Box	$20.00
No. FB Cover (Bryant, No. 1508 Plug Receptacle)	8.00
No. FC Polished Brass Cover, Flush (G. E. Receptacle 9397)	25.00
No. FD Polished Brass Cover, Lapped (G. E. Receptacle 9397)	27.00
No. FE Steel Cover, Flush (G. E. Receptacle No. 9397)	6.00
No. FF Steel Cover, Lapped (G. E. Receptacle No. 9397)	6.00

For outlets and junction purposes No. FA box with the following covers can be used where a small box is necessary.

No. FG Closed Steel Cover and No. FH Open Steel Cover	6.00
No. FH Cover can be used with P. & S. Receptacles Nos. 877, 988 and 577.	
No. FI Cover, with ⅜-inch insulated bushing	12.00
No. FK Cover, Steel, for P. & S. Receptacles Nos. 777 and 977	6.00
No. FL Cover, Brass, for P. & S. Receptacles Nos. 777 and 977	25.00
No. FM Box (3¼ inches diameter, ¾ inches deep), 3½-inch Outlets only in bottom	18.00

No. CA Outlet and Junction Box.

DIMENSIONS—4 inches diameter, 1⅝ inches deep.
OUTLETS—Four outlets in sides and five in bottom. For ½-inch or ¾-inch conduit only.

	Price per hundred
No. CA Box	$20.00
No. CD Cover with ⅜-inch insulated bushing	12.00
No. CB Open Cover or No. CC Closed Cover, and No. CE Flat Steel Cover	6.00
No. CF Flat Steel Cover drilled for standard 10 amp. Rotary Snap Switch	10.00

THE PRATT CHUCK CO., Frankfurt, N. Y.

(Continued on opposite page)

Pratt Chuck Galvanized Stamped Steel Outlet Boxes and Covers—Continued.

No. BA Switch Outlet or Junction Box.

DIMENSIONS—Four inches square, 1⅝ inches deep.
OUTLETS—Eight outlets in sides, five in bottom. For ½-inch or ¾-inch only.

		Price per hundred
No. BA	Box	$20.00
No. BB	Open Cover or No. BC Closed Cover	8.00
No. BD	or No. BE Cover for Hart or Perkins Rotary Switches	8.00
No. BF	Deep Cover for Standard Push Button or Rectangular Base Switches or Flush Plug Receptacles	8.00
No. BG	Shallow Cover for Standard Push Button or Rectangular Base Switches or Flush Plug Receptacles	8.00
No. BH	Cover for 2 Push Button Switches	16.00
No. BI	Cover with ⅜-inch Insulated Bushing	12.00
No. BK	Cover Flat Steel	6.00

No. GA Box for Norbitt, Trumbull, P. & S. and G. E. Receptacles.

DIMENSIONS—4 inches diameter, 1⅝ inches deep.
OUTLETS—Four side Outlets only. For ½-inch or ¾-inch conduit only.

		Price per hundred
No. GA	Box	$20.00
No. GB	Cover for No. C-33⅛ Norbitt Rosette	6.00
No. GC	Cover for No. C-227 Norbitt Receptacle, P. & S. Receptacles Nos. 876, 988 and 577	6.00
No. GD	Brass Cover for No. C-33⅛ Norbitt Rosette	32.00
No. GE	Brass Cover for No. C-227 Norbitt Receptacle, P. & S. Receptacles Nos. 877, 988 and 577	32.00
No. GF	Steel Cover for Trumbull Receptacle	6.00
No. GG	Brass Cover for Trumbull Receptacle	39.00
No. CD	Cover with Insulated Bushing for use with P. & S. Rosettes Nos. 400, 401 and 810	12.00
No. CE	Flat Steel Cover	6.00
No. GK	Cover, Brass, for G. E. Receptacle, No. 9397	24.00
No. GL	Cover, Steel, for P. & S. Receptacles Nos. 777 and 977	6.00
No. GM	Cover, Brass, for P. & S. Receptacles Nos. 777 and 977	32.00

NOTE—Box cannot be furnished with bottom outlets.

Covers for Federal Socket and Rotary Snap Switches.

We furnish steel or polished brass Covers for Federal Sockets for use in connection with our Nos. FA and CA Boxes.

For use with No. FA Box.

		Price per hundred
No. FN	Polished Brass Cover (flush)	$25.00
No. FO	Polished Brass Cover (lapped)	27.00
No. FP	Steel Cover (flush)	6.00
No. FQ	Flat Steel Cover drilled for standard 5-amp. Rotary Snap Switches	10.00

For use with No. CA Box.

		Price per hundred
No. CG	Polished Brass Cover (flush)	$29.00
No. CH	Polished Brass Cover (lapped)	29.00
No. CI	Steel Cover (flush)	6.00
No. CF	Flat Steel Cover drilled for standard 10-amp. Rotary Snap Switch	10.00

Nos. HA, IA and KA Box for Ceiling Outlets in Terra Cotta.

DIMENSIONS—4 inches or 5½ inches diameter, ½-inch or ¾-inch deep. (See price list).
OUTLETS—Five in bottom. For ½-inch or ¾-inch conduit only for HA and IA.

For ¾-inch conduit only, for KA (can be reamed to take 1-inch conduit).

		Price per hundred
No. HA	Ceiling Box ¾-inch deep, 4 inches diameter	$ 9.00
No. IA	Ceiling Box ½-inch deep, 4 inches diameter	9.00
No. KA	Ceiling Box ¾-inch deep, 5½ inches diameter	14.00

No. LA Bracket Outlet and Junction Box.

DIMENSIONS—3-15/16 inches diameter, 2 inches deep.
OUTLETS—Four in bottom, one in top side and two in flat side.
SIZE OUTLETS—For ½-inch and ¾-inch conduit only.

		Price per hundred
No. LA	Bracket Box	$20.00
No. LB	Open Cover	6.00
No. LC	Closed Cover	6.00

No MA Outlet and Junction Box.

DIMENSIONS—4-11/16 inches square, 1⅝ inches deep.
OUTLETS—Eight outlets in sides and five in bottom.
SIZE OUTLETS—For ½-inch or ¾-inch conduit only.

		Price per hundred
No. MA	Box	$28.00
No. MB	Closed Cover, and No. MC Open Cover	10.00
No. MD	Cover with ⅜-inch insulated bushing	14.00

No. NA Deep Outlet and Junction Box for Lath and Plaster Work.

DIMENSIONS—4-11/16 inches square, 2¼ inches deep.
OUTLETS—Eight in sides and five in bottom. For ½-inch, ¾-inch or 1-inch conduit only.

		Price per hundred
No. NA	Deep Box for plaster	$32.00
No. MB	Closed Cover, and No. MC Open Cover	10.00
No. ND	Open Lapped Cover, and No. NE Closed Lapped Cover	11.00
No. MD	Cover with ⅜-inch insulated bushing	14.00

Nos. OA and PA Box for Flush Rotary Snap Switches and Plug Receptacles.

DIMENSIONS—2-5/16 inches wide, 4 inches long, 1⅞ inches deep.
OUTLETS—One in each end. For ½-inch conduit only.

		Price per hundred
No. OA	Box	$20.00

For all Diamond H and H & H rectangular base, rotary snap flush switches.

For Hubbel plug receptacle.

M. & M. shallowest flush push button switch, flush plug and receptacle, and rotary flush switch.

		Price per hundred
No. PA	Box (Cutter Shallow flush push button switch)	$20.00

NOTE—These boxes designed for 2-inch partitions.

Nos. QA and RA Outlet Box for Combination Gas and Electric Fixtures

DIMENSIONS—4 inches diameter; depth for brick work, 1⅝ inches; for lath and plaster, 2¼ inches.
OUTLETS—Four in sides and four in bottom for ½-inch pipe. Where ¾-inch pipe is used box cannot be furnished with bottom outlets.
CENTER NIPPLE—Will pass ½-inch gas pipe.

		Price per hundred
No. QA	Box for brick, 1⅝ inches deep	$40.00
No. RA	Box for lath and plaster, 2¼ inches deep	52.00
No. CB	Open Cover	6.00

Nos. SA and TA Outlet Box for Combination Gas and Electric Fixtures.

DIMENSIONS—4-11/16 inches square; depth for brick work, 1⅝ inches; for lath and plaster, 2¼ inches.
OUTLETS—Two in each of four sides and four in bottom for ½-inch conduit. When ¾-inch conduit is used box cannot be furnished with bottom outlets.
CENTER NIPPLE—Will pass ¾-inch gas pipe.

		Price per hundred
No. SA	Box for brick, 1⅝ inches deep	$46.00
No. TA	Box for plaster, 2¼ inches deep	58.00
No. MC	Open Cover	10.00
No. ND	Open Lapped Cover	11.00

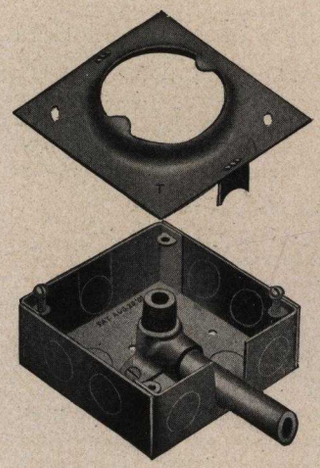
NOTE—Box is carried in stock for ½-inch conduit only.

Approved July 5, '07.

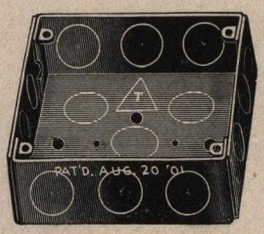
THE PRATT CHUCK CO., Frankfort, N. Y.

Selling Agents: Crescent Company, 103 West Adams St. Chicago, Ill.

"T. & B." Universal Pressed Steel Outlet Boxes and Covers



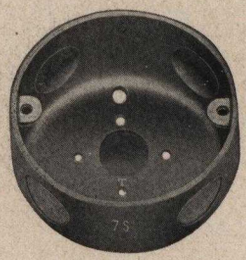
320-S



300-S

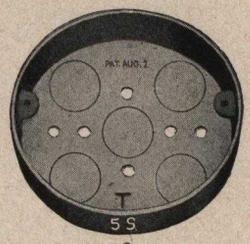
Nos. 300-S and 320-S Universal Steel Outlet Switch Boxes. In No. 320-S, two of the side outlets are so arranged that either a round or U-Shaped hole may be knocked out, making the box suitable for straight or combination gas and electric work. All covers for 300-S fit 320-S.

9-S Outlet or Junction Box. 4″ diam. 1⅝″ deep. List Price, $20.00 per 100.



7-S and 77-S Receptacle Box 3″ diam. 1½″ deep. No. 7-S has four ½″ knockouts in side and one in bottom. 77-S has four ½″ knockouts in side only.

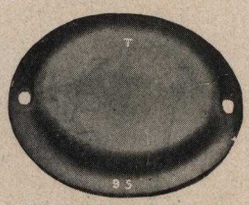
4-S



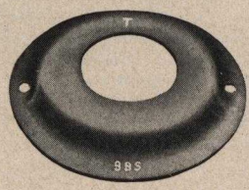
5-S

4-S and 5-S Shallow Ceiling Boxes, designed for terra cotta work where conduit enters from back. Five knockouts in back 4″ diam. ¾″ deep.
4-S without lugs; 5-S with lugs.

Open Cover with lugs.



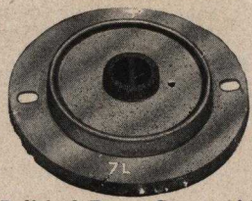
Plain Closed Cover.



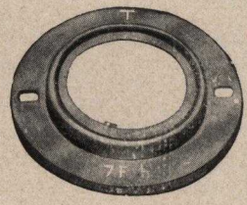
Cover with 13/16, 1¼ or 1½″ hole in center.

Cover with ⅜″ insulating bushing.

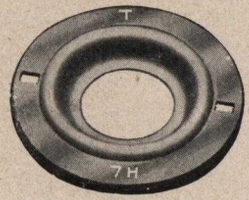
Open Cover for Outlet. 3″ hole, lips ⅝″ high.



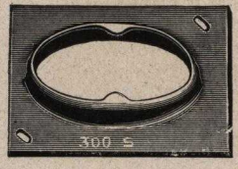
Polished Brass Cover with one or two insulating bushings. Lapped.



Polished Brass Cover for Federal Receptacle. Lapped or Flush.



Polished Brass Cover for G. E. Receptacle 9397. Lapped.



Cover with 3⅞″ Outlet.

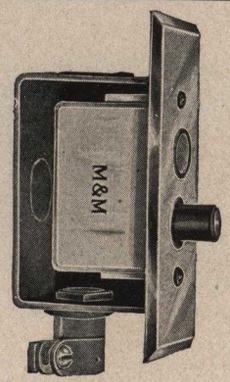
Single Switch Cover.

Closed Junction Box Cover.

Cover for Federal Clamp Receptacle or Socket.

Approved July 30, 1908.

THOMAS & BETTS CO., 299 Broadway, New York, N. Y.

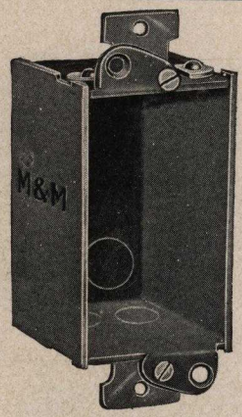


M. & M. Switch in box for Greenfield Conduit.

"M. & M." Shallow Wall Cases, 2" Deep

These wall cases are made for either circular loom or Greenfield conduit, and allow ample room for the "M. & M." shallow flush switch or any rotary flush switch or any receptacle and plug.

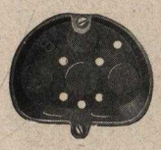
They are adapted for use on new work or old work. They are suitable for shallow partitions or when it is desired to locate a switch near a sliding door, without interfering with the operation of the door. Approved Jan. 3, '08.



MACHEN & MAYER ELECTRICAL MFG. CO., Philadelphia, Pa.

No. 8B. Outlet and Junction Box for ½ in. or ¾ in. conduit. Also 8B Deep for lath and plaster for ½ in., ¾ in. and 1 in. conduit.
Four outlets in sides and five in bottom.

No. 17. Box for G. E. Receptacle, No. 50746. Four outlets in side. For ½ in. conduit.



No. 16. Bracket Outlet and Junction Box for ½ in. or ¾ in. conduit. Four outlets in bottom, one in top side and two in flat side.

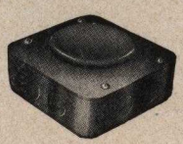
Nos. 18 and 18A for ceiling outlets in terra cotta, for ½ in. or ¾ in. conduit. Five outlets in bottom.

"Bossert."

No. 15. Switch, Outlet or Junction Box for ½ in. or ¾ in. conduit. Eight outlets in sides and five in bottom.

No. 17A for G. E. Receptacle, No. 9397 for ½ inch conduit. Four outlets in sides and one in bottom.

No. 1900. Box for combination gas and electric fixtures for ½ in. or ¾ in. conduit. Eight conduit outlets in sides and five in bottom. One gas outlet in two opposite sides for ½ in. gas pipe.



No. 11B. Outlet and Junction Box for ½ in. or ¾ in. conduit; also 11B Deep for lath and plaster work for ½ in., ¾ in. or 1 in. conduit. Eight outlets in sides and five in bottom of both types.

Also Switch Boxes, Cat. Nos. 1800 and1801, 1700 and 1701.

Approved Oct. 3, '08.

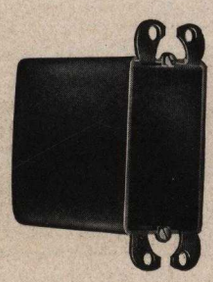
BOSSERT ELEC. CONSTRUCTION CO., Utica, N. Y.

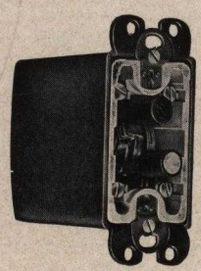
"H. & H." Wall cases for knob and tube work, 4 outlets in bottom for ⅜ in. and 2 in each end for ¼ in. flexible conduit, with knockout blanks. Made for from one to eight switches.

Approved July 16, '08.

Also "H. & H." Wall Case for door switch, for conduit or knob and tube work.

HART & HEGEMAN, Hartford, Conn.



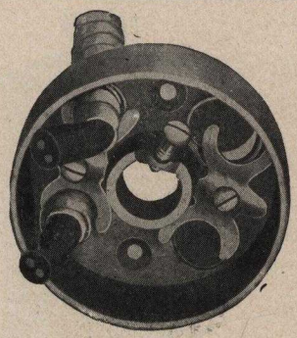


Marshall Switch Box. A one piece pressed steel switch box for knob and tube work Cat. No. 1467.

Approved Jan. 14, '07.

MARSHALL ELEC. MFG. CO., Boston, Mass.

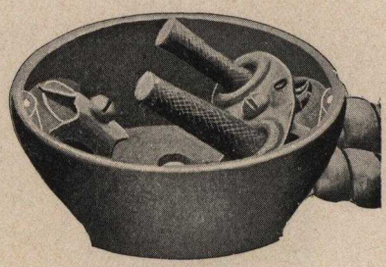
CONDUIT, SWITCH and MOULDING BOXES.—(Continued).

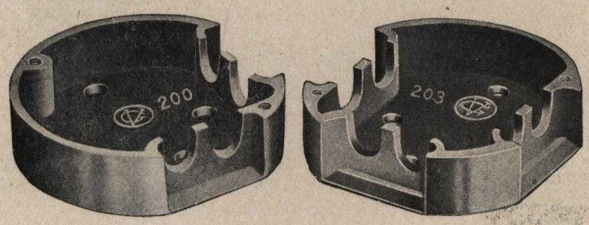


"Flexbox" (formerly "Sarco") combined outlet and junction box for flexible metal conduit and armored cable. Interchangeable. For from one to four cables. Type A, electric only; Type B, combination for ⅜ in. pipe; Type C, combination for ½ in. pipe.

Approved Sept. 11, '05.

STEEL CITY ELECTRIC CO., Pittsburgh, Pa.

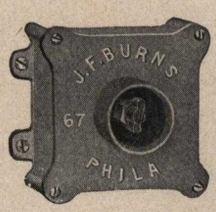




"G. V." Galvanized cast iron boxes with interchangeable covers for use with two wire moulding with ¼-inch grooves.

Approved Aug. 28, 1907.

GILLETTE-VIBBER CO., New London, Conn.



"Burns" water and gas tight, cast iron switch box for mounting snap switches. Cat. Nos. 65-68 incl.

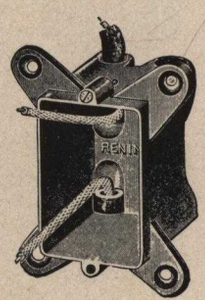
Approved Aug. 11, '08.

JAS. F. BURNS, 47 N. Hutchinson St., Philadelphia, Pa.

"Renim" Outlet Boxes, for flexible tubing. Bracket and ceiling types, straight electric or combination for either two or four wires. Cat. Nos. 102-105 inclusive; 112-115 inclusive, and 122-125 inclusive. Approved March 31, '08.

"Renim." For Knob and Tube work. Style A, single 2, 3, 4 and 5 gang for flush snap switches.

Style B, single to six gang for rotary and push switches. Approved Dec. 14, '04.



RENIM SPECIALTY CO., Boston, Mass.

"Krantz Elevator Box." Cat. No. 448, a cast iron, porcelain lined conduit box, for use as elevator cable outlet.
Approved Aug. 20, 1908.
(Cuts not available.)

H. KRANTZ MFG. CO., Brooklyn, N. Y.

Brass covers with fibre lining 1/32-in. thick. Cat. Nos. 364 and 365 for mounting receptacles.
Approved Sept. 14, 1908.
(Cuts not available.)

BRYANT ELECTRIC CO., Bridgeport, Conn.

Cutter Switch Box, 1905 Standard. Approved Aug. 5, '05.
(Cuts not available.)

THE CUTTER ELECTRIC MFG. CO., Philadelphia, Pa.

Harvard, switch box, type AA for knob and tube work; type BB for iron conduit. Approved Apr. 13, '06.
(Cuts not available.)

HARVARD ELECTRIC CO., Chicago, Ill.

"H. R." switch box. A drawn steel box for knob and tube work. Approved Apr. 9, '07.
(Cuts not available.)

THE HOLABIRD-REYNOLDS ELECTRIC CO., Los Angeles, Cal.

Ostrander Switch boxes for flexible tubing, armored cable, flexible and rigid conduits. Approved Mch. 16, '08.
(Cuts not available.)

W. R. OSTRANDER & CO., New York, N. Y.

"Fancleve" Universal Switch or Junction box for moulding work. Cat. No. 201. Approved Aug. 14, '07.

"Fancleve," iron supporting box for surface snap switches, for use with wooden moulding. Cat. No. 402. Approved April 2, '07.

"Fancleve," cast iron conduit switch and outlet box.
Approved Jan. 10, '07.

"Fancleve," cast iron offset boxes for rigid conduit.
Approved Aug. 12, '07.

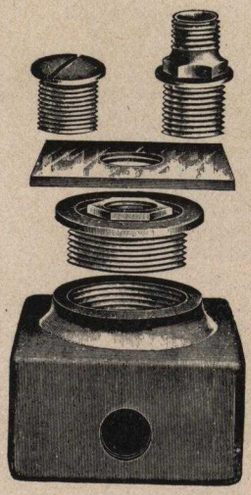
"Fancleve." Cat. Nos. 171 to 175 incl., and 160 to 165 incl., for use with canopies of fixtures in moulding work.
Approved July 5, '08.

"Fancleve." Cat. Nos. 601 to 605 incl., for knob and tube work. Also Cat. Nos. 700 and 701 for flexible armored cable.
Approved July 5, '08.

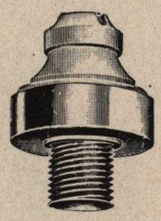
"Fancleve." Cat. Nos. 501 and 351, cast iron conduit switch and outlet boxes.
Approved Feb. 28, '08.

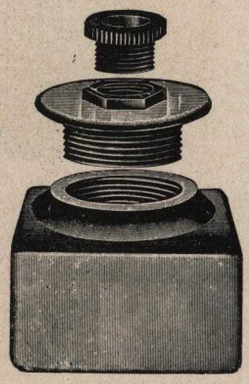
JOHN L. GLEASON, Jamaica Plain, Mass.

"F. A." Floor & Wall Boxes.



Floor Box.





Wall Box.

"FA" Post Office Floor and Wall Boxes.

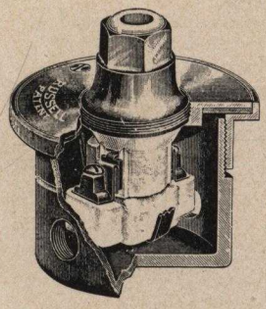
This floor box is made of cast iron with adjustable cap and solid brass polished cover, furnished with brass screw plug and outlet nozzle.

Wall boxes are similar to the floor boxes, except that the adjustable covers are in one piece and they are furnished with insulating outlet bushing. Finished in either nickel plated or polished brass or bronze finish. Both sizes are 4″ x 4″ x 2″ and 3″ deep.

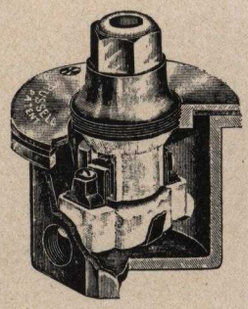
Extra fitting for above floor box made to receive Hubbell receptacle. Approved Oct. 7, '08.

FRANK ADAM ELECTRIC CO., St. Louis.

"Russell Floor Boxes.



No. 5A.



No. 5.

"Russell" No. 5 A. Adjustable top, watertight, floor receptacle complete with plug, cone, and flush cap—good finish—List price, $5.50.

"Russell" No. 5 watertight floor receptacle complete with plug, cone, and flush cap. List price $4.00.

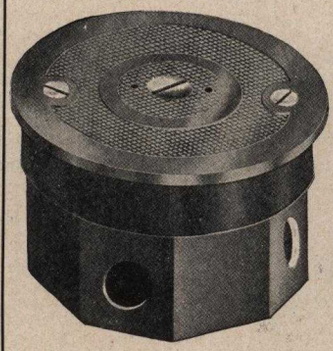
The above are mechanically strong, and electrically good.

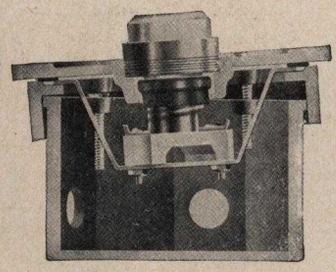
Connections very accessible and easy to wire.

Approved Aug. 20, '07.

RUSSELL & STOLL CO.,
46 Cliff St., New York City.

"Columbus" Floor Outlet Box





An Iron Box with brass cover and fittings. Has adjustable ring which permits the cover to set at almost any angle or level desired. Large space for connections. Porcelain receptacle mounted on stirrup drilled and tapped to take either No. 9397 or Hubbell receptacle.

	List Price.
Iron Box with Adjusting Ring	$1.85
Brass Cover, Plug, Protecting Ring and Gasket	2.10
Steel Strap D. & T. for receptacle	.05
Box Complete	$4.00

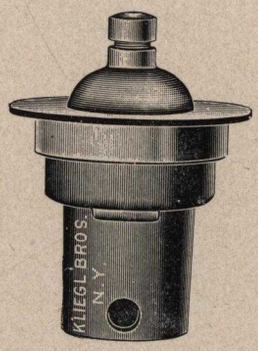
Approved Aug. 20, '07.

THOMAS & BETTS CO.,
299 Broadway, New York, N. Y.

CONDUIT BOXES, FLOOR OUTLET.—(Continued).

Fullman Watertight Adjustable Floor Outlet Box. Iron box, adjusting ring, brass floor plate and nozzle. Approved Aug. 20, '07. Std. pkg. 20 boxes.

STEEL CITY ELECTRIC CO., Pittsburg, Pa.



Kliegl Waterproof Floor Outlet Box. Cat. No. 300. Approved Oct. 31, 1907.

UNIVERSAL ELEC. STAGE LIGHTING CO., Kleigl Bros., Props.
New York, N. Y.

Cat. No. 100
Iron box, brass floor plate and nozzle. Approved Mar. 20, 1908.

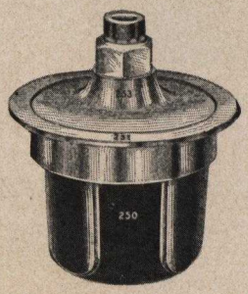
ARTHUR FRANTZEN CO.,
92 W. Van Buren St., Chicago, Ill.

"Simplex" Floor Receptacle or Box. No. 3000. 3 A. 250 V. Cast iron box with brass floor plate and cap. Approved Aug. 20, '07.

STANLEY & PATTERSON,
New York, N. Y.

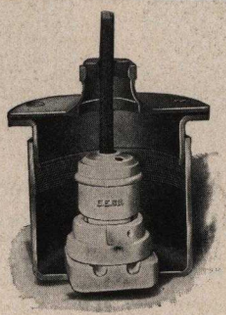
Hunt Watertight Floor Outlet. Cat. No. 300. Cast iron box with brass floor plate and cap. Hubbell Floor Plug, 3A, 250 V. Approved Sept. 26, '07.

ELECTRIC FITTINGS CO.,
Trumansburg, N. Y.



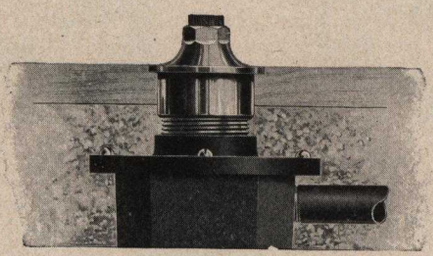
"Fountain" Universal Floor Outlet Box, with adjustable floor ring for nozzle or ½ in. to 1 in. iron pipe. Approved Aug. 20, '07.

JOHN FOUNTAIN, JR.,
New York, N. Y.



G. E. "Adjustable" and "P. R." Watertight floor outlet boxes. Cat. Nos. 76471 and 76459. Approved Aug. 20, 1097.

GENERAL ELECTRIC CO.,
Schenectady, N. Y.

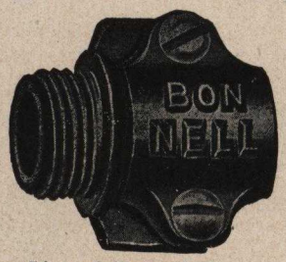


Knickerbocker Watertight Floor Outlet Box. Iron box and floor plate. Adjustable brass casing for Hubbell Special Attachment Plug. Approved Aug. 20, '07.

LORD ELECTRIC CO., New York, N. Y.

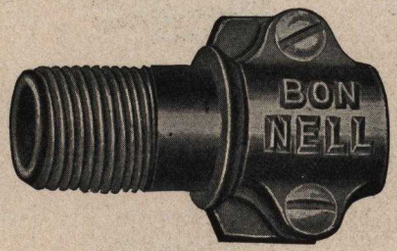
CONDUIT OUTLET BUSHINGS and COUPLINGS.

The Bonnell Conduit and Cable Connectors, for use with flexible or armored cable. All fittings are galvanized.



Price List of Bonnell Connectors for Flexible Conduit and Flexible Armored Conductors.

No.	Coupling.	For	Stand. Pack.	L. P. Per C.
1205	⅜ in.	B. X. Cable	500	$10.00
1210	½ in.	Flex. Conduit	500	12.00
1215	¾ in.	Flex. Conduit	250	17.00
1220	1 in.	Flex. Conduit	100	24.00
1225	1¼ in.	Flex Conduit	100	30.00



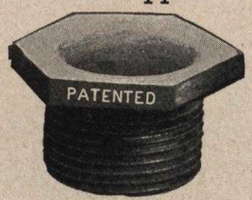
Price List of Bonnell Panel Box Connectors for Flexible Conduit and Flexible Armored Conductors.

No.	Coupling.	For	Stand. Pack.	L. P. Per C.
1105	⅜ in.	B. X. Cable	250	$14.00
1110	½ in.	Flex. Conduit	250	14.00
1115	¾ in.	Flex. Conduit	100	22.00
1120	1 in.	Flex. Conduit	100	30.00
1125	1¼ in.	Flex. Conduit	100	40.00

Approved Aug. 2, '07.

WILLIAM A. BONNELL, 132 Church St., New York.

"Chase Nipple."

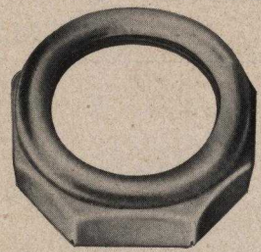


Made of mallable iron finished in enamel, is a perfect mechanical connection between box and conduit. It allows of adjustment avoiding exactness in cutting conduit, prevents abrasion and occupies the minimum amount of space in the box.

Size	St. Pkg.	List Price Per 100	Size	St. Pkg.	List Price Per 100
⅜ inch	100	$8.00	1¼ inch	100	$18.00
½ inch	of	8.00	1½ inch	of	20.00
¾ inch	assorted	12.00	2 inch	assorted	30.00
1 inch	sizes	15.00	2½ inch	sizes	50.00

Approved Feb. 21, 1906.

"Shawmut" Outlet Bushing.

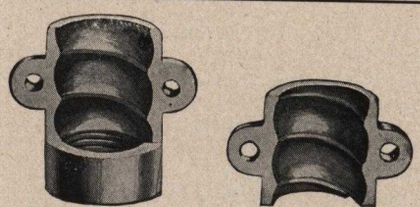


Octagonal in shape making it easy to set in place. The outer portion is perfectly rounded forming an even surface. Is uniform and has perfect threads. Copper plated.

Size	Std. Pkg.	List Price Per 100	Size	Std. Pkg.	List Price Per 100
½"	1000	$ 5.00	1½"	50	$20.00
¾"	100	8.00	2"	50	30.00
1"	100	15.00	2½"	25	50.00
1¼"	100	18.00	3"	25	80.00

Approved Dec. 16, 1904.

CHASE-SHAWMUT CO., Newburyport, Mass.



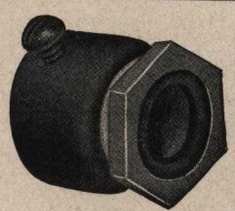
"Chase" Flexible Conduit Coupling.

This coupling is for joining Greenfield Flexible Metallic conduit to any rigid iron armored conduit, having standard gas pipe thread.

½-inch . . . . . $12.00 per 100
¾-inch . . . . . 18.00 per 100

Approved May 19, '08.

CHASE-SHAWMUT CO., Newburyport, Mass.



Flexible Conduit Bushing for connection with Outlet box

For Unlined Conduit

"Erickson" Insulated Outlet Bushing. For ½ to 3 in. Conduit. Approved Dec. 12, '04.

BOSSERT ELEC. CONSTRUCTION CO., Utica, N. Y.

CONDUIT OUTLET BUSHINGS and COUPLINGS.—(Continued.)

Flexible Steel-Armored Cord with Rosette and Socket Bushings

No. 5303
Rosette Bushing

No. 5302
Terminal Bushing

No. 5304
Socket Bushing

Coupling No. 5104

No. 6140
Galvanized Clamp Panel Box Connector

90° Connector
Nos. 6192 and 6193

No. 5320
Lead Bushing for Flexible Conduit

Coupling No. 5105

No. 6120
Galvanized Clamp Panel Box Connector

45° Connector
Nos. 6190 and 6191

No. 5115
Bushing for BX Conductors

Approved 1907.

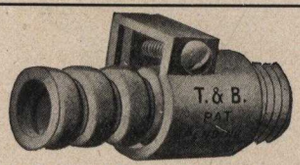
SPRAGUE ELECTRIC CO., 527 West 34th St., New York.

"T. & B." Bushings.

These bushings are Malleable iron, one piece. Thoroughly tinned, non-breakable and rust proof. Can be furnished in black enameled instead of tinned at the same price.

Approved Sept. 26, 1906.

Size	Std. Pkg.	List Price Per 100	Size	Std. Pkg.	List Price Per 100
3/8"	1000	$ 5.00	2 1/2"	25	$50.00
1/2"	1000	5.00	3"	25	80.00
3/4"	100	8.00	3 1/2"	20	250.00
1"	100	15.00	4"	20	400.00
1 1/4"	100	18.00	4 1/2"	20	450.00
1 1/2"	50	20.00	5"	20	500.00
2"	50	30.00	6"	15	600.00



"T. & B." Hood Connector.

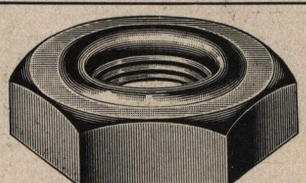
A coupling for securing flexible steel conduits and armored cable at outlets.

No breakage, for they are malleable heavily tinned. No turning, for gripping device makes it impossible. Absolute ground as nut bites into the metal. Adjustment instantaneous. Threading perfect and extra long.

	Std. Pkg.	List Price Per 100
3/8" for BX Conductors	100	$ 7.50
1/2" for 1/2" Flexible Metallic Conduit	100	8.25
3/4" for 3/4" Flexible Metallic Conduit	100	11.00

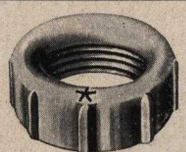
Approved July 5, '08.

THOMAS & BETTS CO., 299 Broadway, New York, N. Y.



Appleton for Unlined Conduit.
Approved Nov. 18, '05.
Sizes and std. pkgs.: 1/2 in.—1000; 3/4 in., 1 in., 1 1/4 in.—100; 1 1/2 in., 2 in.—50; 2 1/2 in., 3 in.—25.

APPLETON ELECTRIC CO., Chicago, Ill.

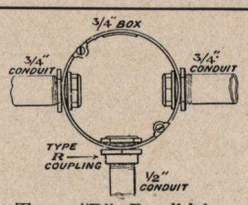


"Star" tinned malleable iron bushing for rigid unlined Conduit.

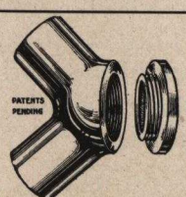
"Fullman" brass bushing for rigid unlined conduit.

Size and std. pkg.: 3/8 in., 1/2 in.—1000; 3/4 in.; 1 in., 1 1/4 in.—100; 1 1/2 in., 2 in.—50; 2 1/2 in., 3 in., 3 1/2 in., 4 in.—25; 4 1/2 in.—25; 5 in.—20; 6 in.—15. Approved Sept. 26, '06.

STEEL CITY ELECTRIC CO., Pittsburg, Pa.



Type "R" Bendkick
For use in securing 1/2 in. conduit to metal boxes having 3/4 inch holes.
Approved Aug. 31, '08.



Type "L" Bendhick
Right angle coupling for rigid conduit.
Approved Aug. 1908.

FAIRMOUNT ELECTRIC MFG. CO., Philadelphia, Pa.

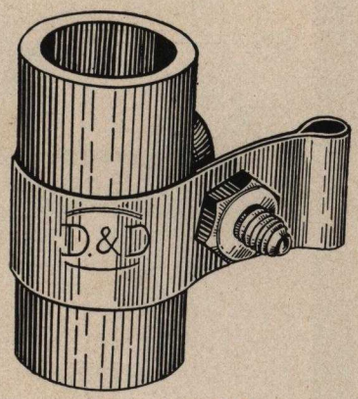
GROUND CLAMPS.

The D. & D. Clamps.

The D. & D. CLAMPS are made of soft strip copper, in sizes to conform to the exact diameter of standard pipe from ½ to 3 inch.

The superiority of this clamp lies in its construction, as it is easily adjusted and will fit any shape pipe.

There are no detachable parts to become lost. It is neat in construction and appearance.



Patent Applied For.

The loop in which the ground wire is soldered, takes any size copper wire, including No. 4 B & S.

It is self contained and cannot lose the bolt or nut.

Being flexible, can be attached to lead cable without injury to same.

No iron parts to become rusted.

Approved Feb. 11, '08.

DEVER ELECTRIC COMPANY, 1931 Wolf St., Philadelphia, Pa.

"Shawmut" Ground Connection Clamps.

For grounding the secondary wires and secondary distributing systems and also for grounding the metal sheaths on cable and for grounding conduit installations.

Two piece, single bolt, maximum contact.

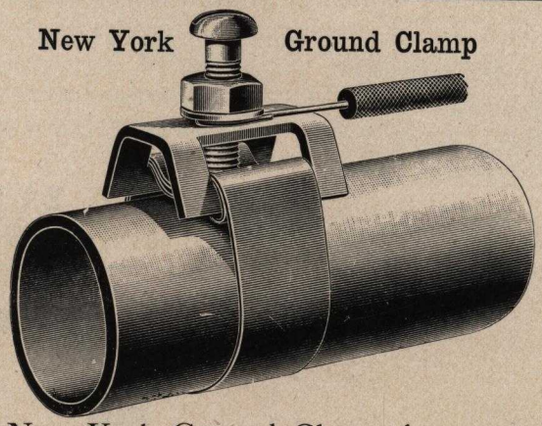
Cat No.	Size	Wire Hole	Each	Std. Package
3661	½ inch	For No. 4 wire	$0.24	
3662	¾ inch	For No. 4 wire	.28	
3663	1 inch	For No. 4 wire	.34	
3664	1¼ inch	For No. 4 wire	.40	100
3665	1½ inch	For No. 4 wire	.46	assorted
3666	2 inch	For No. 4 wire	.52	sizes
3667	2½ inch	For No. 4 wire	.58	
3668	3 inch	For No. 4 wire	.64	

Special Clamps at special prices.

Approved Aug. 20, '07.

CHASE-SHAWMUT CO.,
Newburyport, Mass.

New York Ground Clamp



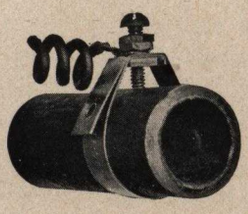
New York Ground Clamp for connecting Telegraph and Telephone ground wires to pipes or cables.

TO APPLY. Set the screw back from the clamping plate, pass the strap around the pipe, and through the slot in the plate. Turn the screw until the strap is tightened firmly about the pipe. Insert the ground wire between the ground plate and washer, and set up the lock nut until the wire is secured. Pipe should be thoroughly cleaned before applying the clamp. For use only on signalling systems.

List Price $10.00 per 100.

Approved Aug. 20, '07.

YONKERS SPECIALTY CO., Yonkers, N. Y.



Blackburn Ground Clamp. A copper strip secured to pipe by set screw. Approved Mar. 19, '07.

No. 1. For ⅜ in. to 1¼ in. Pipe inclusive.

No. 2. For 1½ in. to 3 in. Pipe inclusive.

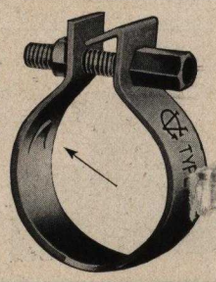
Approved for use on signalling systems.

GEO. R. BLACKBURN,
Cleveland, Ohio.

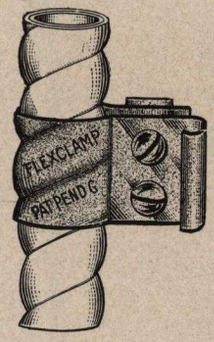
"G. V." Ground Clamp, Type A. Size and std. pkg. up to ¾ in., 100; to 1¼ in., 75; to 2 in., 50; to 3 in. 25. Made of copper and heavily tinned.

Approved Aug. 21, '07.

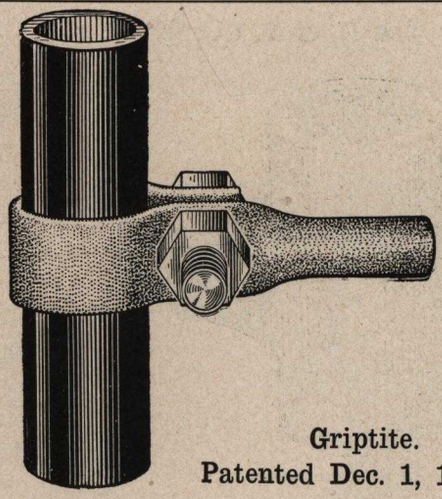
GILLETTE-VIBBER CO.,
New London, Conn.



GROUND CLAMPS.—(Continued.

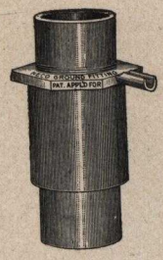


Flexclamp.



Griptite.
Patented Dec. 1, 1908.

Neco Fitting



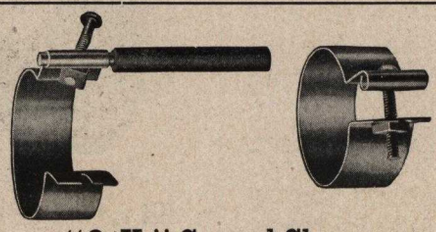
Showing method of attaching to pipe.

"Griptite" Clamps and "Neco" Fittings are used on *Rigid Conduit.* The Griptite is made of rolled copper tubing (lug and clamp being *one piece*). They are made pipe sizes ½ to 4" and conform to the exact diameter of the pipe.

"Neco" Fittings are a brass casting made to screw on pipe ahead of the coupling and cannot therefore be readily removed. Sizes ½ to 3".

"Flexclamps" are intended for use in connection with Sprague Conduit and BX Conductors and fit perfectly the helical construction of the conduit. Made at present in five sizes from No. 14 to No. 10 inclusive "BX Conductors" and ⅜ to 1" Conduit. Approved Mar. 20, '08.

NOVELTY ELECTRIC COMPANY
Manufacturers and Jobbers of Electrical Merchandise, 50-52-54 N. Fourth St., Philadelphia, Pa.

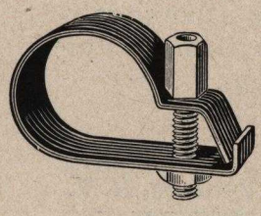


"O. K." Ground Clamp.

This clamp is designed to make a perfect contact with the pipe or cable and a proper connection with the grounding wire.

It is made of stamped spring copper and has a nut and screw that will not come loose. A sample will be mailed on request. Approved Aug. 20, '07 for electric light service.

PETTINGELL-ANDREWS COMPANY, Boston, Mass.



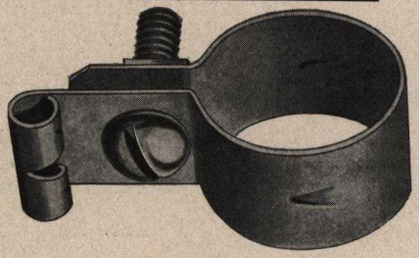
"Bulldog" Clamp for rigid conduit. A ½-inch copper strap with brass clamping screw forming lug for soldered connection to ground wire. Fits No. 4 wire and smaller. Sizes ½, ¾ and 1 in, std. pkg. 100; 1¼, 1½ and 2 inches, std. pkg. 75; 2½ and 3 inches, std. pkg. 50.

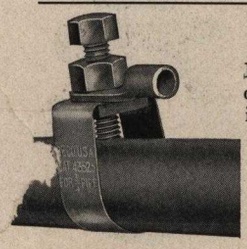
Approved March 16, '08.

FAIRMOUNT ELECTRIC MFG. CO.,
2322 Market St., Philadelphia, Pa.

"Perma-Effect" one piece ground clamp. Bolt and nut are directly connected to the band to avoid the possibility of becoming lost. Approved Feb. 5, '08.

H. T. PAISTE CO., Philadelphia, Pa.





G. E. Ground Connection Pipe Clamps. Removable lugs bolted to strip bronze clamps, all sizes. Cat. Nos. 43525-43530 inclusive, for from ¾ in. to 3 in. pipe.

Approved June 21, '07.

GENERAL ELECTRIC CO.,
Schenectady, N. Y.

"Boston" ground clamp, a device consisting of two tinned brass plates with set screws (for use on signalling systems only.)

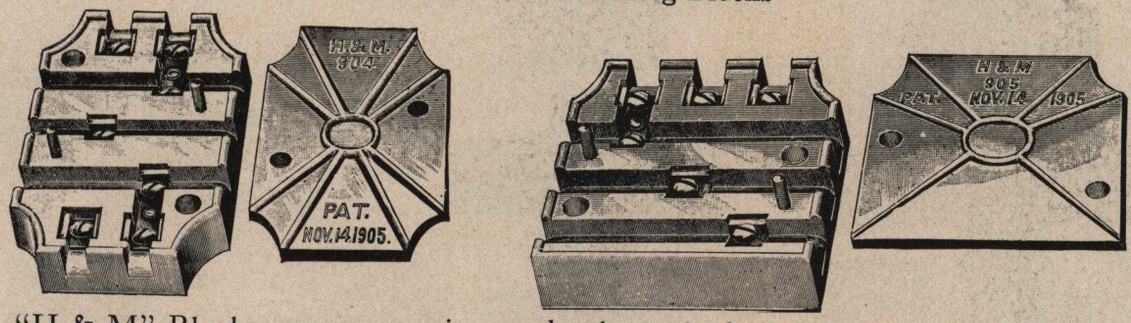
Approved Sept. 10, 1908.

(Cuts not available.)

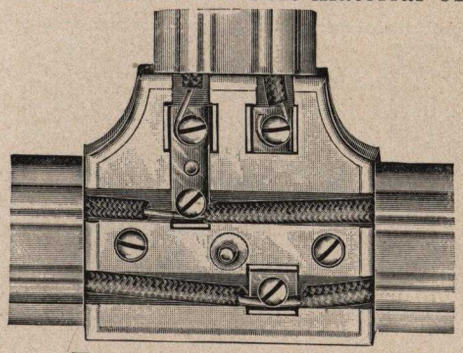
CAMERON APPLIANCE CO., Everett, Mass.

MOULDING FITTINGS.

"H. and M." Moulding Blocks

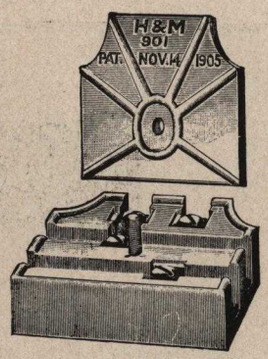


"H & M" Blocks are a convenient and safe method of making branch connections in moulding. They eliminate the objectionable features of the old method, and can be installed in a short space of time. They are approved for both moulding and cleat work and are made of the best material obtainable.



Made for two and three wire mains and two or three wire branches.

Two wire main to single two wire branch. No. 901.
Two wire main to double two wire branch. No. 902.
Three wire main to single two wire branch. No. 903.
Three wire main to double two wire branch. No. 904.
Three wire main to single three wire branch. No. 905.
Three wire main to double three wire branch. No. 906.
First three mentioned Std. Pkg. 100; last three, Std. Pkg. 50.



For convenience in balancing the load on three wire circuit No. 903 is provided with removable contact which allows the use of either outside main. Write for prices and discounts.

Approved Sept. 19, 1905.

ELM CITY ENGINEERING CO., New Haven, Conn.

The Jordan Splice Protector.

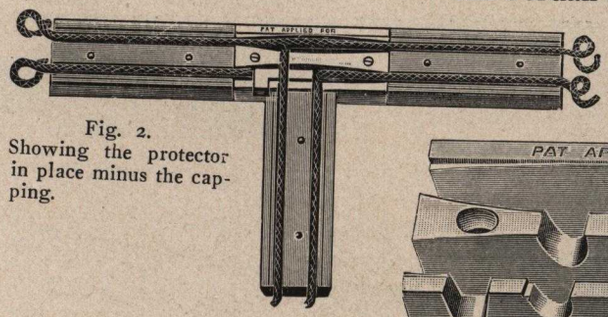


Fig. 2.
Showing the protector in place minus the capping.

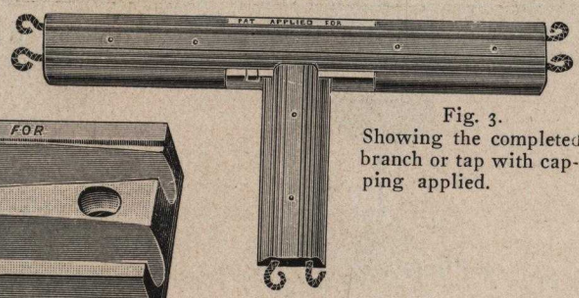


Fig. 3.
Showing the completed branch or tap with capping applied.

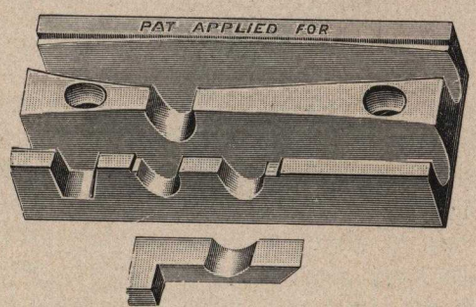


Fig. 1. Showing the splice protector.

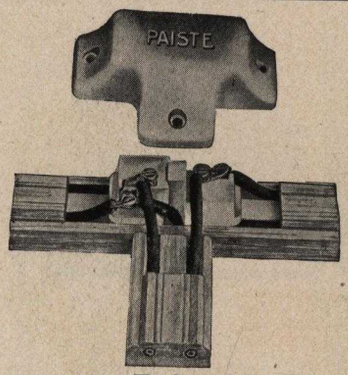
A porcelain block for branch in moulding line, two or three wire, or any combination thereof.

It provides a solid, substantial soldered and insulated splice, provides a fire and waterproof protection at the splice and is held in position by the capping of the moulding. It it practically invisible and no cutting out of moulding is necessary. There are no exposed wires at the splice and no chance of the capping nails being driven through the splices.

Approved Jan. 3, '07.

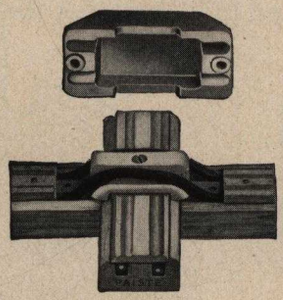
74 Beekman St. **JORDAN BROS. INC.** **New York, N. Y.**

MOULDING FITTINGS.—(Continued), BUSHINGS, MERCURY VAPOR LAMPS and SPECIAL ARC LAMPS.



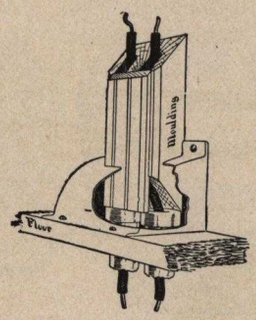
Taplets.
Approved Nov. 13, '05.
All Styles 2 and 3 Wire Single and Double Branches.

H. T. PAISTE CO., Philadelphia, Pa.



Paiste Cross over block with cover detached. Cat. No. 4095.

Two-piece porcelain fitting to be used at moulding cross overs. For two and three wires. Approved Nov. 2, '07.

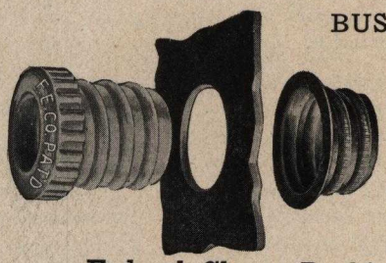


Gleason Floor Tube and Moulding Protector.

Approved Nov. 28, '04.

JOHN H. GLEASON, Jamaica Plain, Mass.

BUSHINGS.



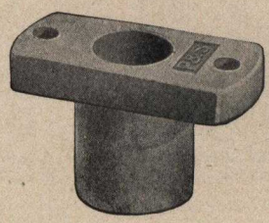
Federal Clamp Bushings

Internal diameters up to 1⅝ inches. Have metal clamping ring which screws onto threads on the porcelain.

Especially adapted to metal and glass work. Smaller diameters in lengths up to 2½ inches.

Approved Nov. 29, '05.

FEDERAL ELECTRIC CO., Chicago, Ills.

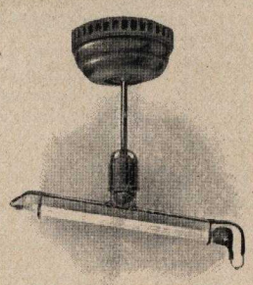


"P. & S." all porcelain bushings for use on wood or steel cutout cabinets, supported by means of screws or stove bolts. Cat. Nos. 55, 56, 57.

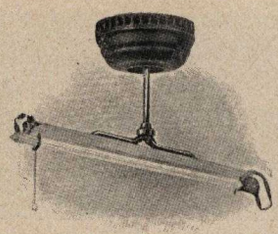
Approved Feb. 24, '08.

PASS & SEYMOUR, INC., Solvay, N. Y.

LAMPS, MERCURY VAPOR.



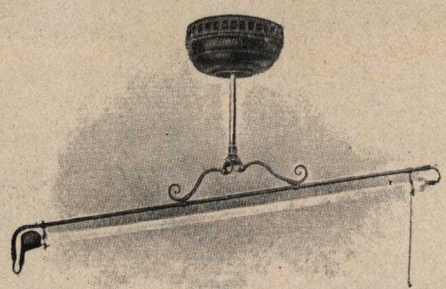
Automatic Type "H" for Direct Current. Two Automatic Type "H" Lamps in Series on 90-130 Volts; Four Automatic Type "H" Lamps to run in Series on 180-260 volts.



Type "C" for Alternating Current. One Type "C" Lamp to run singly on 90-130 Volts; one type "C" to run singly on 220 Volts.

Approved June 22, '06.

COOPER HEWITT ELEC. CO., New York, N. Y.



Type "K" for Direct Current. One Type "K" Lamp to run singly on 90-130 Volts; two Type "K" Lamps to run in series on 180-260 Volts.

Approved except where exposed to accumulations of inflammable flyings.

SPECIAL ARC LAMPS.

Enclosed lens box arc lamp on a standard carrying knife switch and rheostat, each enclosed in an iron box, 30 A., 125 V.

(For illustrations of these arc lamps see Page 22.)

Approved June 22, '06.

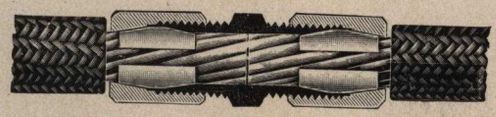
UNIVERSAL ELECTRIC STAGE LIGHTING CO., 1393-1395 Broadway, New York, N. Y.

"Solar" Therapeutic arc lamp. Horizontal carbons, adjustable rheostat mounted on lamp stand, 15 A., 125 V. Approved May 20, 1908.

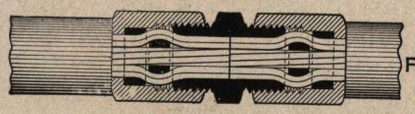
MODERN MEDICINE CO., Battle Creek, Mich.

JOINTS, CABLE.

Dossert Solderless Connectors



2-Way, Type A, Showing Details.

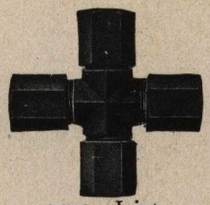


Type B, 2-way Connector.

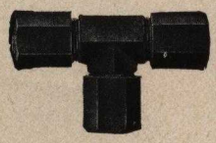
Type C, 2-way Connector.

Swivel Lug.

Angle Lug

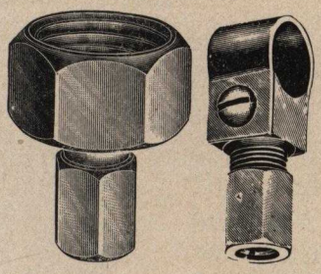


4-way Joint.

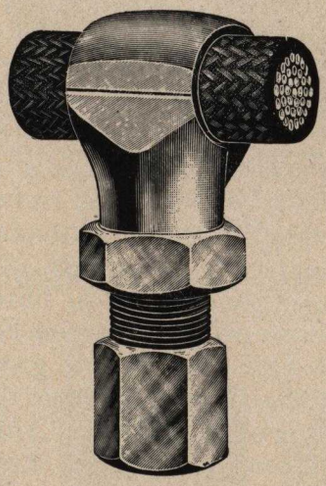


3-way Joint

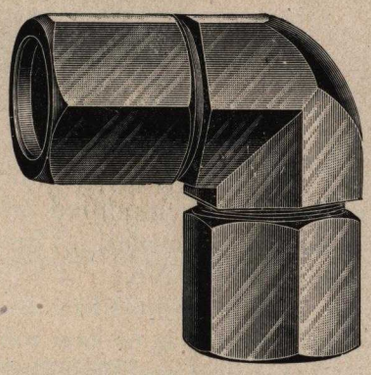
Y-Joint.



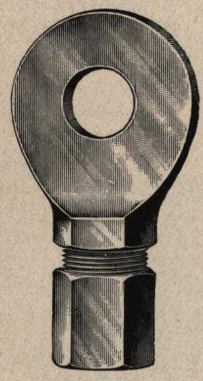
Grounding Secondaries.



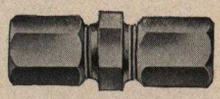
Cable Tap

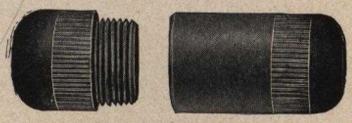


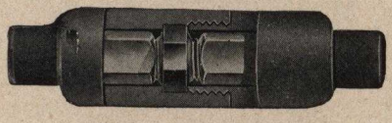
Elbow



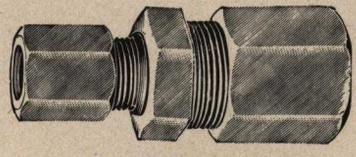
Back Lug.



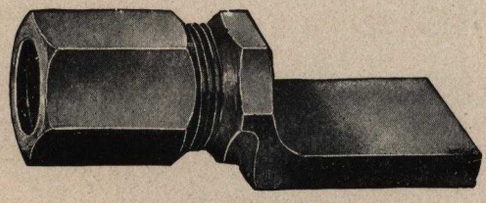




Dossert Insulated Cover.



Reducer.



Front Terminal Lug.

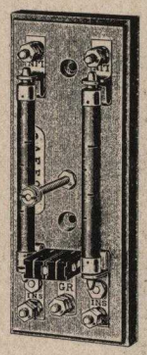
Dossert connectors, terminals, and cable taps for making electrical connections without the use of solder. Made in types A, B and C. Can be applied in a few minutes. Type A is for all indoor and underground wiring for both stranded and solid conductor. Type B has somewhat greater tensile strength than type A, and should be used on overhead construction only. Type C for high tension work is made in the two styles above mentioned and has round nipples and nuts. With Dossert Joints any combination of different sizes of cables and wires can be connected together. The cable tap will tap from any size main to any size branch. Lugs of all kinds, front, back, angle and swivel; insulated motor leads, two-ways, three-ways, four-ways, elbows, Y's, service box plugs, caps for grounding secondaries to gas pipe. The applications of Dossert Joints to electrical construction are innumerable. Designs made to meet any possible requirement.

When ordering state whether for stranded or solid. Give the circular millage of the cable and the number of strands of wire of which it is composed. Or the exact outside diameter of the cable and number of strands. Or the exact diameter of the strand and the number of strands. Where the cable is of special make or extra flexible, a small sample of the cable should be sent with the order. Prices and discounts on application. Approved April 27, '07.

DOSSERT & COMPANY, 242 West 41st St., New York, N. Y.

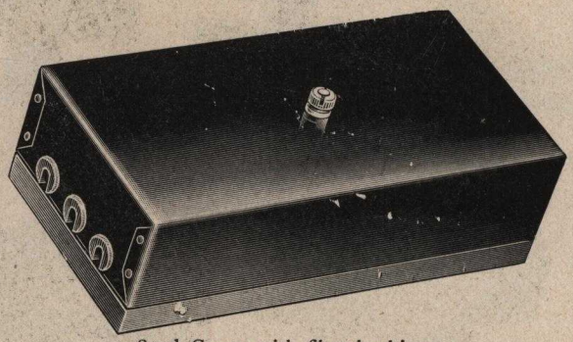
TELEPHONE PROTECTORS

"American" Protectors



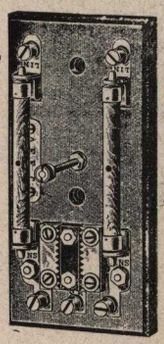
Nos. 990 and 991 Individual Subscriber's Station Protector, mounted on glazed porcelain base.

No. 997 is made for out door use and the box part is entirely of porcelain; mountings of heavy brass; tubular fuses of fibre or wood as desired, and the fuse is enclosed in asbestos braid. The lightning arrester is self-cleaning and dust proof. The wires enter through slanting openings in the side and connections are made by lock nut binding post. It is furnished with iron lid enameled in red with over-lapping edges and with 1/8" rubber gasket. It can also be used as a test box.



Steel Cover with fibre bushings.

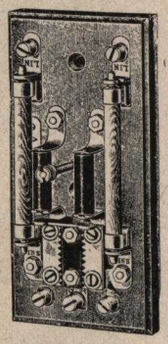
No. 997, Line Fuse Box and Carbon Lightning Arrester for out-door use.



No. 998, Individual Subscriber's Station Protector, without heat coils.

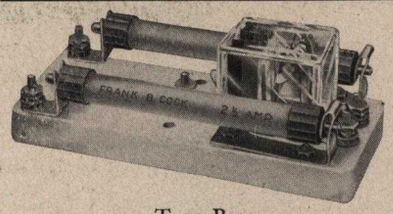
No. 999 is a combined heat coil, tubular fuse and carbon lightning arrester, mounted on a heavy glazed porcelain base and pressed steel cover. The heat coil is of a self soldering type. Code or Cat. No.9. The fuses are of wood or fibre as ordered. lined with asbestos braid. Code or Cat. No. 999-F. The lightning arrester is of saw tooth type with carbon ground plate, is self cleaning and dust proof, has large discharge surface and is adjustable. The mountings are of heavy brass, 'American Hook Contacts' for the fuses, all connections with knurled thumb nuts or screw nuts, as ordered.

No. 998 is the same as No. 999 excepting that it is not equipped with heat coils. Approved May 23, '06.



No. 999 Individual Subscriber's Station Protector, with heat coils.

AMERICAN ELECTRIC FUSE CO., Muskegon, Mich.

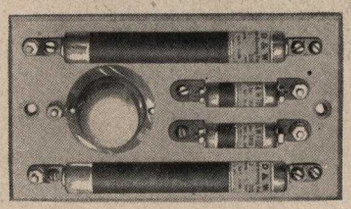


Type B-4.

Type B-5 with enclosed fuse and carbon lightning arrester but with no heat coils. Type B-4 with enclosed fuse, carbon cutout and heat coil combination.

Approved Oct. 16, '06.

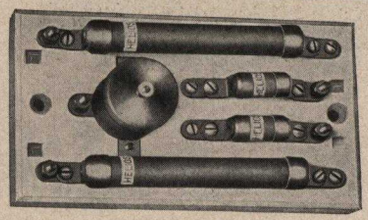
FRANK B. COOK, Chicago, Ill.



Cat. No. 3104.

Cat. No. 3100 single pole cutout. Cat. No. 3102 single pole combination cutout and Cat. No. 3104 double pole combination cutout.

D. & W. FUSE CO., Providence, R. I.

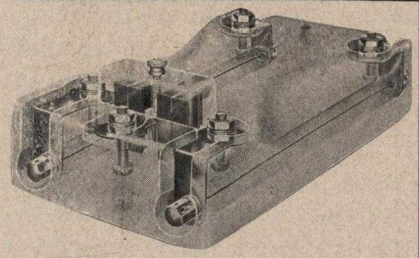


Helios No. 4. Enclosed fuse, carbon cutout and heat coil combination.

Approved Feb. 6, '06.

HELIOS MFG. CO.,

Bridesburg, Philadelphia, Pa.



Porcelain block with line fuses and carbon lightning arrester. Cat. No. 258. Fuses are strips of fusible metal threaded through chambers in the porcelain.

Approved Oct. 10, '07.

STERLING ELECTRIC CO., Lafayette, Ind.

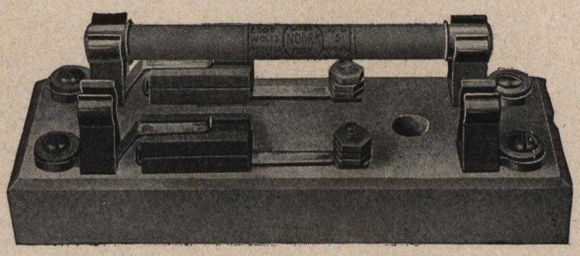
Enclosed fuse, carbon cutout and heat coil combination.

Approved Dec. 12, '04.

(Cuts not available.)

AMERICAN TELEPHONE & TELEGRAPH CO.,

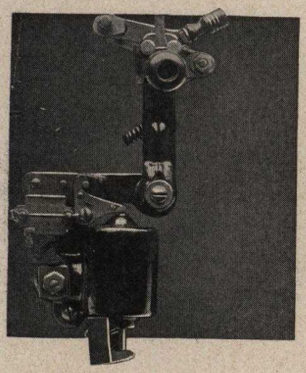
Boston, Mass.



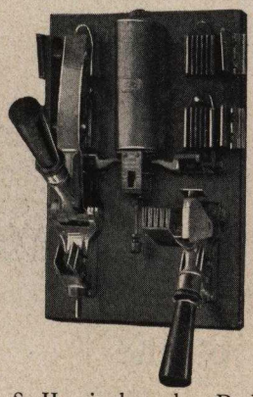
"Noark" Single and Double Pole, Porcelain Base, with or without carbon lightning arrester. Approved March 4, '07.

H. W. JOHNS-MANVILLE CO., New York, N. Y.

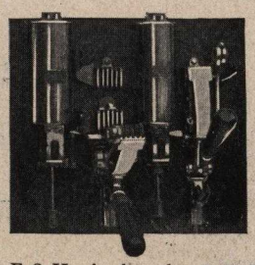
CIRCUIT BREAKERS.



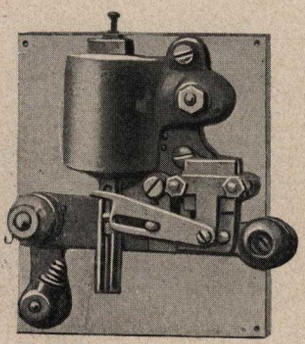
C K type, single pole, non-closable upon overload or short circuit, for protection of generators, motors, etc.



S H, single pole; D H, double pole; plain overload.



F S H, single pole; F D H, double pole; overload and no-voltage release, for use with large motors, front and back connected.



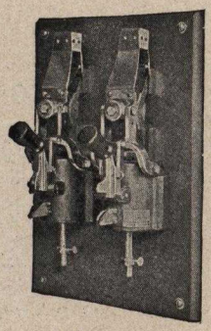
P U L type, underload release, single pole, for use with storage batteries, etc.

P E L type, no-voltage release, opens on failure of voltage, single pole, for protection to motors, etc.

Also D K and D K E type, no-voltage, non-closable upon overload or short circuit.
Also U. S. H. single pole, and U. D. H. double pole types, under load and overload.
Also "L. M." type, single, double and triple pole, overload d. c. and a. c. circuits, single, double and triple coil.
Also F S D single pole, and F D B double pole types, no-voltage and overload release.
Also S B single pole, and D B double pole, plain overload release
Also C G S single pole, and C G D double pole types, overload and reverse current, for storage batteries, boosters, etc.

Approved Dec. 13, '03.

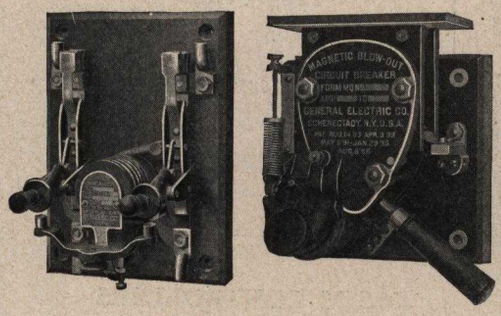
WARD LEONARD ELECTRIC CO., Bronxville, N. Y.



Type K. Forms L, M, O, P, Q. All capacities, 200 and 600 Volt.

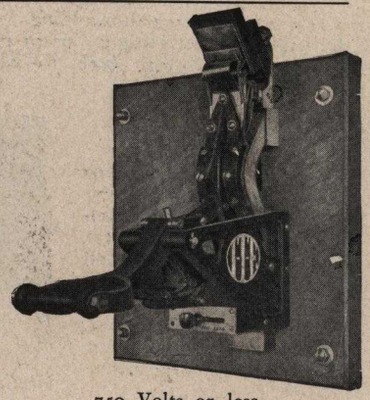
Approved Feb. 24, '08.

CONDIT ELECTRICAL MFG. CO., Boston, Mass.



G. E. Approved Nov. 25, '04.

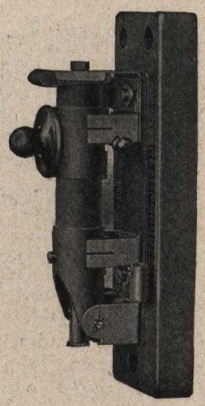
GENERAL ELECTRIC CO., Schenectady, N. Y.



750 Volts or less.

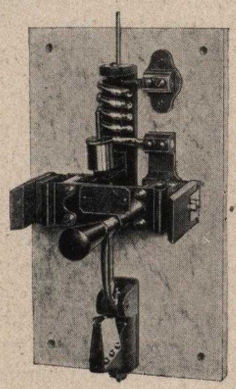
I. T. E. Approved Nov. 29, '04.

CUTTER ELECTRICAL & MFG. CO., Philadelphia, Pa.



Type A.

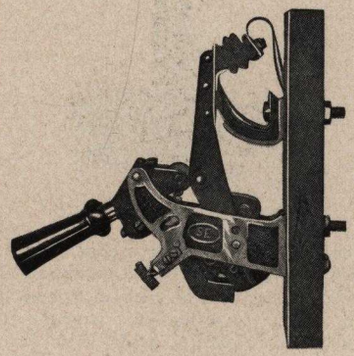
Automatic, carbon break, single pole, front connection for D. C. circuits of not over 750 volts.



Type F.

Automatic, carbon break, front connection, single pole, with attachment for manual operation. Approved Aug. 31, '08.

WESTINGHOUSE ELEC. & MFG. CO., Pittsburg, Pa.



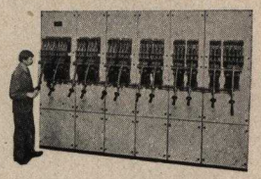
"S. E." single pole types for service on circuits of 500 V. or less.

Approved Jan. 24, '06.

SWITCHBOARD EQUIPMENT CO., Bethlehem, Pa.

Cutler-Hammer Current Controlling Devices.

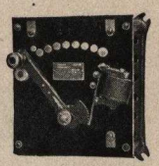
STARTING RHEOSTATS



Multiple Switch Motor Starter for 1500 H. P. Motor (Bulletin 10½)

More than 300 types and sizes of standard motor starting rheostats are manufactured and a large number of these devices are carried continually in stock from which shipments can be promptly made.

The following Bulletins (free on request) describe approved motor starters:



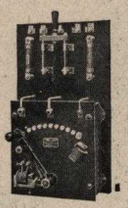
Motor starting rheostat (Bulletin 10)

Bulletin 10—Describing motor starting rheostats with no-voltage release—¼ to 35 H. P.

Bulletin 13—Describing a similar line of motor starters with moisture-proof resistance—particularly adapted to damp locations.

Bulletin 16—Describing motor starters designed for rear of switchboard moulding.

Bulletin 17—Describing a line of motor starters provided with both no-voltage and overload release.

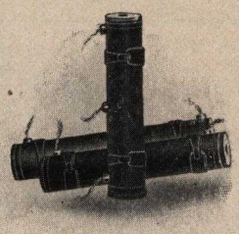


"Universal" type of motor starter (Bulletin 21)

Bulletin 21 — Describing what is known as the "Universal" motor starter, comprising a starting rheostat, knife switch and fuses all mounted on the same slate panel.

Bulletin 10½—Describing multiple switch starting rheostats for use with large motors.

RESISTANCE UNITS



These Resistance units are of the well known "Carpenter" type, consisting of porcelain tubes wound with wire and encased in a covering of cement. Accurately and carefully made, with ample allowance made for overload. Described in Bulletin 93.

THE electric controlling devices here illustrated are the product of the largest plant in the world devoted to the manufacture of such apparatus.

Approved:

May 9, 1907; August 27, 1907; August 28, 1907; January 18, 1908; February 21, 1908; February 26, 1908; March 17, 1908.

DRUM CONTROLLERS

Machine Tool Controller

This line of approved drum controllers includes Bulletins 66, 66A and 69 (crane controllers), Bulletins 67, 67½, 68 and 68½ (printing press and machine tool controllers). Bulletin 72B (drum type reversing switch for electric elevators) and Bulletins 77 and 78 (machine tool controllers). Some of these controllers are non-reversible while others are designed to operate motor in either direction. In some of them speed regulation is secured by armature resistance only, while others in addition to giving speed reduction by armature resistance provide for speed increase by field weakening.

Descriptive Bulletins, price lists, etc., on request.

SPEED REGULATORS

Speed Regulator (Bulletin 40)

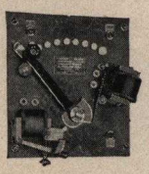
A very complete line, ranging from ¼ to 50 H.P.

Bulletin 40 — Describes motor speed regulators equipped with no-voltage release only.

Bulletin 41 — Describes a similar line of apparatus provided with both no-voltage and overload release.

Bulletin 42—Describes the "Universal" type of speed regulator, comprising rheostat, double pole knife switch and fuses mounted on the same slate panel.

Bulletin 44—Describes compound speed regulators which regulate by inserting resistance in the armature circuit for slow speeds and into the shunt field circuit for high speeds.



Speed Regulator (Bulletin 41)

Bulletin 44½—Describes compound speed regulators similar to Bulletin 44 but mounted "Universally" i. e. with knife switch and fuses on same panel.

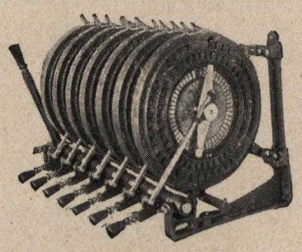
FIELD REGULATORS

Dynamo field regulator

These dynamo field regulators are thoroughly well made and handsome in appearance. Standard constructions embrace three sizes (9 inch, 12 inch and 15 inch plates) and two styles—front of board field regulators and regulators designed for rear of switch board mounting.

Bulletin 32 describes this line of apparatus.

THEATER DIMMERS



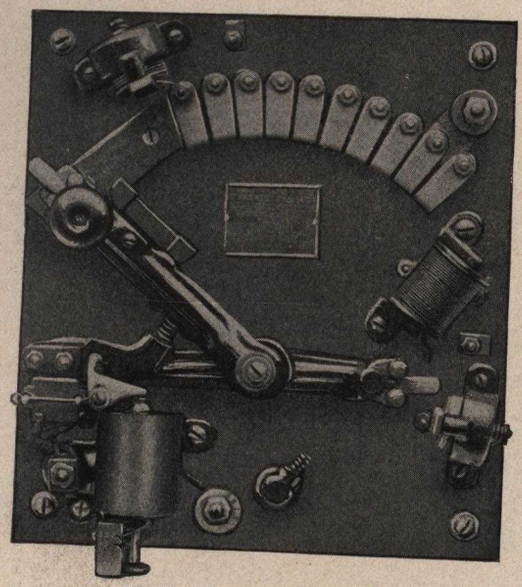
"Simplicity" Theater Dimmer

"Simplicity" type dimmers are used on 80 per cent of New York and Chicago theatres and in the leading play houses throughout the country. Fully described and illustrated booklet entitled "Stage Lighting." Send for a copy.

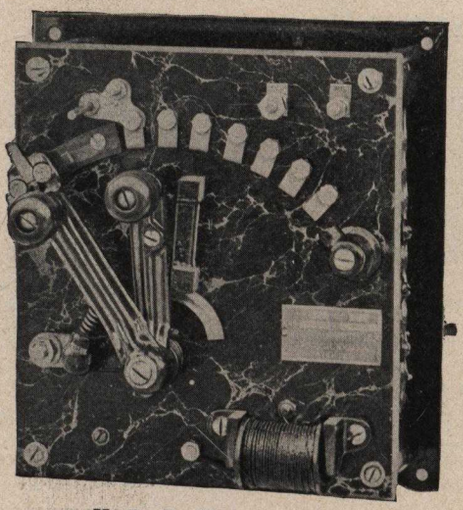
THE CUTLER-HAMMER MFG. CO., Milwaukee.

New York Office: Hudson Terminal (50 Church St.) *Chicago*: Monadnock Block. *Boston*: 176 Federal St.
Pittsburg: Farmer's Bank Bldg. *Pacific Coast Agents*: Otis & Squires, 111 New Montgomery St., San Francisco.

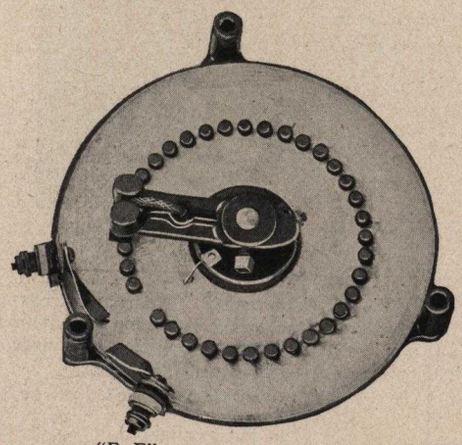
RHEOSTATS.—(Continued).



"S K E" type starter. Interlocking overload circuit breaker and no-voltage release. Enclosed sand box type resistances used in all motor starters.



H R E. No-voltage release armature speed controller. Enclosed ventilated type resistances. Enameled resistance units used in all cases where enamelled plates are not used.



"F F" type enamelled field rheostat.

WARD LEONARD

Kind of Apparatus	Catalogue type	Catalogue number
Armature Speed Controllers:—		
For Machine and Similar Duties, and Ventilating Fan Duty		
With Independent, Interlocking, Automatic "Overload" Circuit Breaker and Automatic "No-Voltage" Release	KRE & KVE	B 1
For Machine and Similar Duties, and Ventilating Fan Duty		
With Automatic "No-Voltage" Release	HRE & HVE	B 1
Machine and Similar Duties	TR	B 1
No Automatic Features	R	B 2
For Ventilating Fan Duty, No Automatic Features	VR	B 1
With Extension Slate, Switch and Fuses	KRN, KVN, HRN & HVN	B 3
Equipped with 20 Steps of Resistance for Speed Control by Field Regulation	RIK, VIK, RIH & VIH	B 4
Equipped with 20 Steps of Resistance for Speed Control by Field Regulation with Switch and Fuses	RIKN, VIKN, RIHN & VIHN	B 5
Motor Field Rheostats:—		
Without Protective Features	FM, SM & EM	C 1
With Automatic "No-Voltage" Release Protective Device		
Generator Field Rheostats:—	FF, FB & CR	D 1
Theatre Dimmers:—		
For Front and for Back of Board, Etc.	BD, IBD & SD	F 1
Motor Starting Rheostats:—		
Interlocking "Overload" Circuit Breaker and "No-Voltage" Release	SKE	A 1
Automatic "No-Voltage" Release	SUE	A 1
With Switch and Fuses Attached	USK & USU	A 2
With Extension Slate, Switch and Fuses 1902 Government Specifications	SKN & SUN	A 3
With Extension Slate, Switch and Fuses 1905 and 1906 Government Specifications	CSK & CSU	A 4
With "Tight Casing Enclosing All Current Carrying Parts"	ESK & ESU	A 5
With "Tight Casing Enclosing All Current Carrying Parts" and Attached Switch and Fuses Enclosed in Tight Casing	UESU & UESK	A 6
With 20 Steps of Resistance for Speed Control by Field Regulation	SIK & SIH	A 7
With 20 Steps of Resistance for Speed Control by Field Regulation with Extension Slate, Switch and Fuses	SIKN & SIHN	A 8
Arranged for Back of Board Mounting	SKEB & SUEB	A 9
Reversing Motor Starter with Automatic "No-Voltage" Release	RSU	A 10
Reversing with "Tight Casing Enclosing All Current Carrying Parts"	ERSU	A 10

Approved, '07.

WARD LEONARD ELECTRIC CO., Bronxville, N. Y.

RHEOSTATS.—(Continued).

Compensarc

For Moving Picture Machine Control.

The Compensarc eliminates all disadvantages, such as waste of electric current, danger of fire, unsteady or flickering light and saves at least 60% on light bills.

The Compensarc is made for alternating current circuits only and can be furnished for 110 or 220 volts at 60 or 133 cycles.

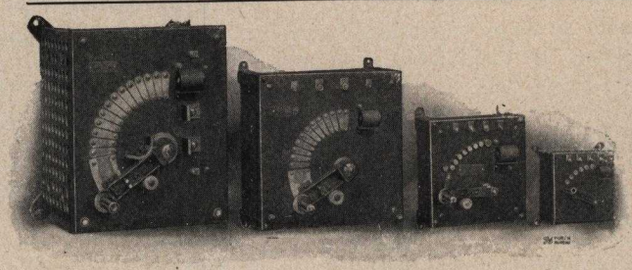
This device is adjustable, maintaining the same voltage at the arc for three different intensities of current and light. There is no break in the circuit in making these adjustments, nor is the stability of the arc affected. Complete details in Booklet J5013, sent on request.

FORT WAYNE ELECTRIC WORKS,

"Wood" Systems

Fort Wayne, Indiana.

748



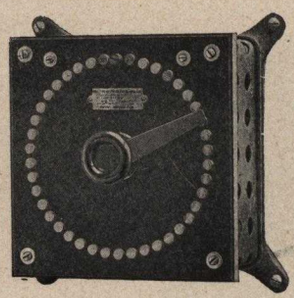
G. E. motor starting rheostats, types S A and S B, and speed regulating rheostat, type RA; 125-500 V. Approved Jan. 18, '08.

Also Rheostat Panels, types AA and UP. Approved Oct. 22, '07.

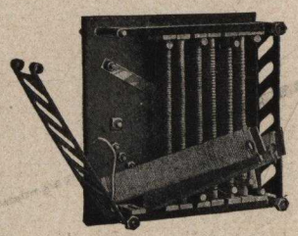
Also Form Panel PM resistance units, sizes A, B and C. Approved Jan. 17, '08.

Also Types FB-1 and FB-3 generator field rheostat for 110, 220 and 500 V. Approved Nov. 9, '07.

GENERAL ELECTRIC CO., Schenectady, N. Y.



Flat-Lever Contact Face Plate.



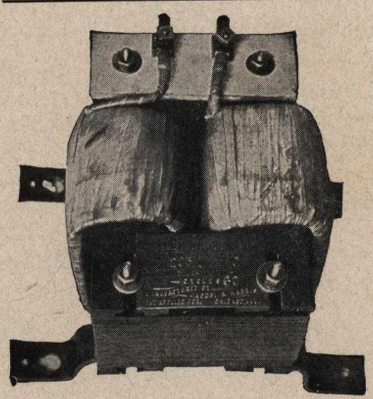
Rear View Showing "Bars."

"Westinghouse" multiple-switch motor starting rheostats. Approved July 5, '08.

Also motor starting rheostats, open wire "bar" and "grid" types, 125-650 V., ¼ to 120 H. P. Approved Sept. 10, '07.

Also regulating rheostats open wire "bobin" and "bar" types and "grid" type, 125-650 V. Approved Sept. 10, '07.

WESTINGHOUSE ELEC. & MFG. CO., Pittsburg, Pa.



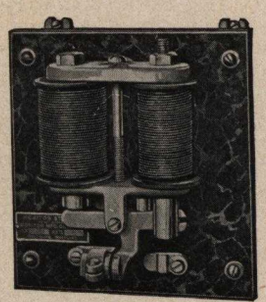
J. & H. Reducer for alternating currents. A choke coil for use with the arc lamp of moving picture outfits, 110 or 220 volts.

Approved June 3, 1908.

JACOBI & HARRIS,
Chicago, Ill.

"Monitor" Automatic Starter, for 1 H. P. motors at 110, 220 or 500 volts.

MONITOR MFG. CO.,
Baltimore, Md.



"National" current regulators and speed control rheostats for continuous duty service. These rheostats do not have either no-voltage or over-load release devices.

Approved June 8, '08.

(Cuts not available.)

NATIONAL RHEOSTAT CO.,
Chicago, Ill.

Magnetic Rheostat, a transformer with adjustable resistance coils in secondary circuit. For use with the arc lamp of moving picture machine outfits. 110 or 220 volts.

Approved July 15, '08.

(Cut not available.)

WINCHESTER ELECTRICAL WORKS,
Chicago, Ill.

"Indicator-Compensator." An auto-transformer for use in the arc lamp circuit of moving picture machine outfits. Primary voltage 90-115 A. C.

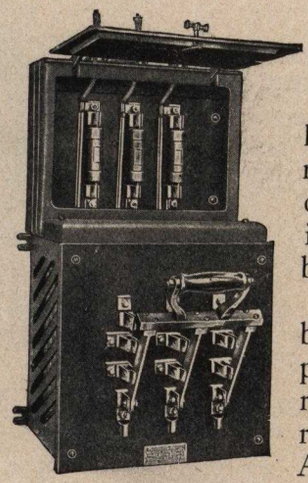
Approved Sept. 10, '08.

(Cut not available.)

DON J. BELL,
Chicago, Ill.

AUTO STARTERS.

Type "S" and Type "R" Starters for Induction Motors.



Type "S"

Type "S" consists of an arrangement of knife switch and fuses whereby an induction motor of 5 H. P. or under may be connected directly to the line without fuses during starting and fuses are inserted when motor is brought up to speed.

Type "R," consists of resistance designed to be inserted in the starter winding during the period of starting to cut down the rush of current that would otherwise take place. This resistance is mounted in a substantial iron box. Approved June 5, '08.

Type "R"

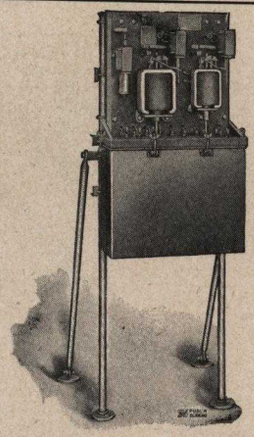
Fairbanks-Morse Electrical Mfg. Co.
Indianapolis, Ind.

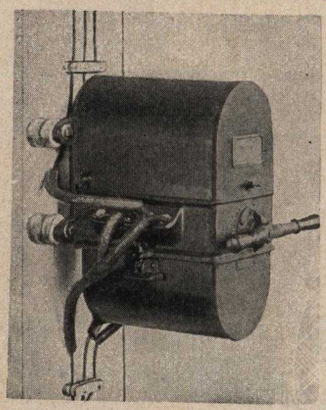
Hand operated oil immersed. Approved Mar. 13, 05.

Also automatic self-starting compensators, 5 to 50 H. P., 110 V., and 5 to 100 H. P., 220, 440 and 500 V., 2 and 3-phase. Approved Oct. 1, '08.

Type S. A. C., Form A, automatic self-starting compensator, oil immersed, 110-220-550 V. Approved Nov. 22, '07.

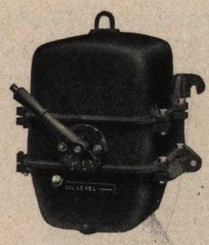
GENERAL ELECTRIC CO., Schenectady, N. Y.





Allis-Chalmers Oil Immersed. Approved July 5, '06.

ALLIS-CHALMERS CO., Milwaukee, Wis.



Westinghouse, Oil Immersed. Approved Mar. 13, '05.

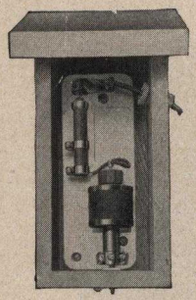
WESTINGHOUSE ELEC. & MFG. CO., Pittsburg, Pa.

Transformer Starters, 250-440 and 600 Volts, 7½ to 60 horsepower. Two or three phase. With special 4 pole double throw switching device mounted on slate front. Approved May 11, 1908.

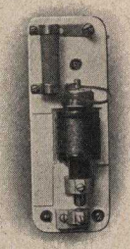
TRIUMPH ELECTRIC CO., Cincinnati, Ohio.

LIGHTNING ARRESTERS.

Garton-Daniels Lightning Arresters for A. C. & D. C. Circuits



No. 3941.
350 to 750 volt D. C. Pole Arrester in Wooden Box.



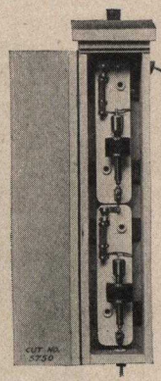
No. 834.
350 Volt D. C. Station Arrester.

Garton-Daniels Lightning Arresters are made for all voltages, either for direct or alternating current.

All types are mounted on porcelain bases and for outside use are furnished with either wooden or metal covers.

They provide an easy path for lightning and absolutely restore the normal current after the discharge has passed through them. Bulletins describing each of the types will be sent to interested persons.

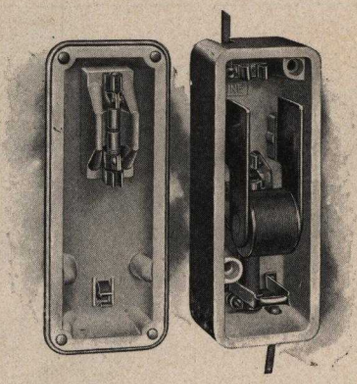
No. 3745.
3500 Volt A. C. Station Arrester.



No. 5750.
5000 Volt A. C. Pole Arrester.

ELECTRIC SERVICE SUPPLIES CO.,

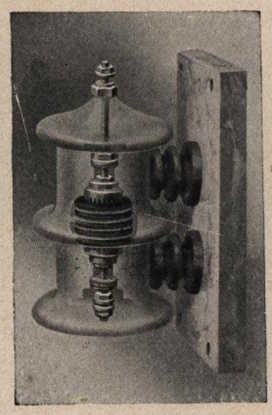
Philadelphia **Keokuk, Ia.** **Chicago.**



G. E. All types for a. c. and d. c. circuits.

Approved Oct. 5, '06.

GENERAL ELECTRIC CO., Schenectady, N. Y.

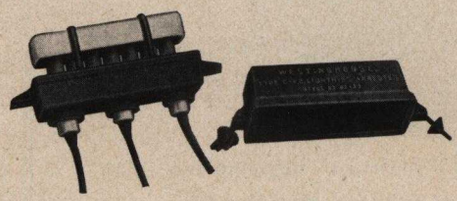


"Shaw Non-Arcing," for a. c. and d. c. circuits.

Approved March 2, '08.

LORD ELECTRIC CO., Fuller Bldg., New York, N. Y.

Type M. P.



Type C.

Standard types described in circular 1045.

Approved Dec. 14, '04.

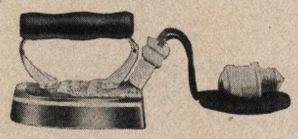
WESTINGHOUSE ELECTRIC & MFG. CO.,
Pittsburg, Pa.

HEATERS, ELECTRIC.

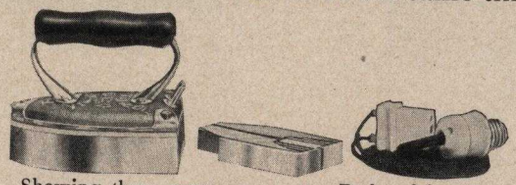
"American"
Electrical Heating Devices.

"American" electric heating devices have been on the market for the past 14 years and have gained a high reputation for efficiency, safety and low cost of operation.

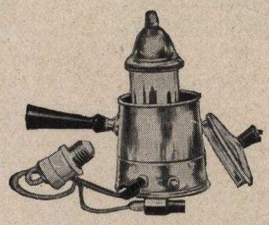
The cuts shown below represent but a small proportion of the 189 different devices of the "American" type of electric heating devices. which embraces every form of electric heating for which there is a demand and which at the same time is practical.



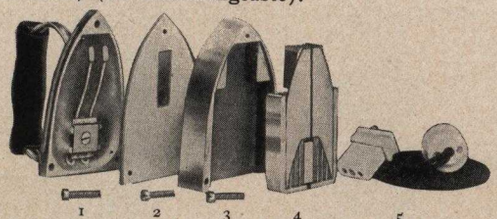
American "Steel Clad" Irons



Showing three component parts: Body of iron indestructible, Element, a separate unit that can be replaced or renewed when necessary (merely slips in and out of body, connections made automatically); Cord and plugs that can be replaced or renewed when worn out; Extra parts may be kept on hand, (all interchangeable).

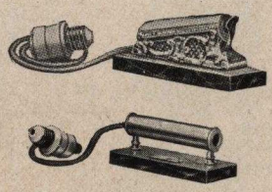


Water Heater
Small Size with Nursery Bottle

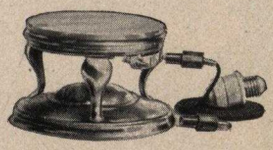


1 2 3 4 5

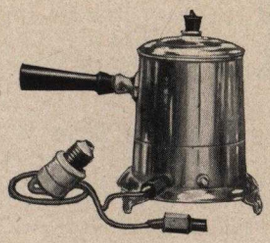
No. 1. Top plate with handle and connectors; No. 2 Asbestos heat retaining wall preventing free radiation, thereby saving at least 20% of the energy; No. 3, Bottom Plate; No. 4, "Steel Clad" element, practically a solid mass of steel; No. 5, Cord with detachable plug and separable attachment plug.



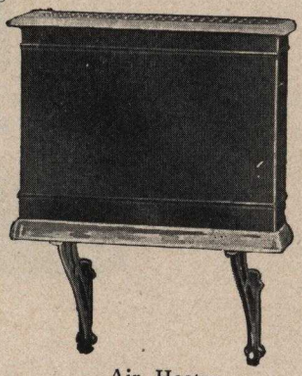
"American Curling Iron Heaters



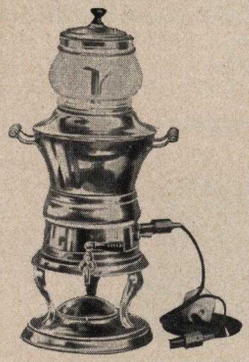
"American" Disc Stoves



Water Heater
Large Size With Stand.

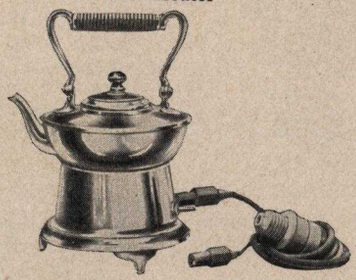


Air Heater



Coffee Percolator

"American" Glue Pot.



"American" Tea Kettle

"American" Chafing Dish.

Patents issued and pending—Approved Aug. 26, Nov. 13 and Nov. 14, 1907.

An illustrated catalogue showing the full line of "American" electric heating devices together with interesting information on the subject of electric heating will be sent on application.

Manufactured by

AMERICAN ELECTRICAL HEATER CO., Detroit, U. S. A.
Oldest and Largest Exclusive Makers in the World.

HEATERS, ELECTRIC.—(Continued).

No. 1205

No. 1209

Simplex Chafing Dishes

Furnished with six feet of cord and a lamp socket plug.

No. 1205 3 Pints, Three Heats, Nic. Pl. 500 watts.....$16.00
No. 1215 3 Pints, Three Heats, Sil. Pl. 500 watts..... 29.00
No. 1209 3 Pints, Three Heats, Nic. Pl. 500 watts..... 18.75
No. 1219 3 Pints, Three Heats, Sil. Pl. 500 watts..... 31.50

Other styles and sizes listed in Simplex Catalog.

No. 1262

No. 1293

No. 1286

Simplex Spray Coffee Urns and Pots

Furnished with six feet of cord and a lamp socket plug.

No. 1262 4 Pint Pot, One Heat, Nic. Pl. 300 watts...$10.50
No. 1293 3 Pint, Urn, One Heat, Nic. Pl. 300 watts... 11.50
No. 1286 2 Pint, Urn, Three Heat, Nic. Pl. 250 watts.. 14.25

Other styles and sizes listed in Simplex Catalog.

No. 1253

Simplex Tea Kettles

Furnished with 6 ft. of cord and lamp socket plug. Arranged for three heats.

No. 1253 1 qt. Nic. Pl. 250 watts..$12.85
No. 1254 same Sil. Pl. 250 watts.. 18.75
No. 1872 same Nic. Pl. 440 watts.. 15.00
No. 1873 same Sil. Pl. 440 watts.. 20.00
No. 1255 1 qt. Nic. Pl. 250 watts.. 12.00
No. 1256 same Sil. Pl. 250 watts.. 18.00
No. 1245 Quick Heating 550 watts 11.00

No. 1751

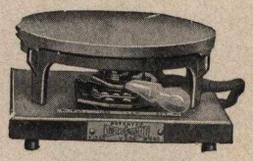
No. 1753

Simplex Cooking Combinations

Stove and utensils separable. Six feet of cord and plug. Stove gives three heats. Utensils copper tin lined and nickel plated.

No. 1751 1½ Pt. Saute Pan 4½ in. stove 220 watts...$ 8.50
No. 1755 3 Pt. Saute Pan 6 in. stove 440 watts... 11.50
No. 1753 1½ Pt. Tea Kettle 4½ in. stove 220 watts.. 7.75
No. 1754 3 Pt. Tea Kettle 6 in. stove 440 watts... 10.50
No. 1750 2 Pt. Blazer 4½ in. stove 220 watts... 9.50
No. 1752 3 Pt. Blazer 6 in. stove 440 watts... 12.00
No. 1756 3 Pt. Double Boiler 6 in. stove 440 watts... 12.00

Same combinations with one heat stove $2.00 less list price.



No. 1734

No. 1703

Simplex Electric Stoves

Mounted on a slate base and furnished with six feet of cord. Those under 500 watts furnished with lamp socket plug.

	One Heat		Three Heat	
No. 1700	3¼" dia.	100 w. $5.00	(special)	
No. 1701	4½" dia.	220 w. 4.00	No. 1731 4½" dia.	220 w. $6.00
No. 1702	6 " dia.	440 w. 6.00	No. 1732 6 " dia.	440 w. 8.00
No. 1703	7 " dia.	600 w. 7.00	No. 1733 7 "dia.	600 w, 9.00
No. 1704	8 " dia.	735 w. 9.00	No. 1734 8 " dia.	735 w. 11.00
No. 1705	10 " dia.	1100 w. 12.00	No. 1735 10" dia.	1100 w. 15.00
No. 1706	12 " dia.	1300 w. 15.00	No. 1736 12" dia.	1300 w. 18.00
No. 1708	15 " dia.	1800 w. 18.00	No. 1738 15" dia.	1800 w. 21.00

Simplex Ranges

Twelve styles. Each range includes an oven, a broiler and several stove heaters with the utensils that fit them. Each heater is controlled by a separate switch on the front. Two sizes of tops 21½x27½ and 25x36. Each style gives a different combination of utensils, including Tea Kettles, Blazers, Saute Pans and Double Boilers. Prices in Simplex Catalog.

Simplex Curling Iron H'trs

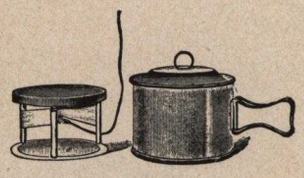
No. 1274 (cut) 60 watts.....$3.00
Marcel Wave Curling Iron Heaters
Wall Fixture Curling Iron Heaters
Theatre Curling Iron Heaters (with grease paint cup).

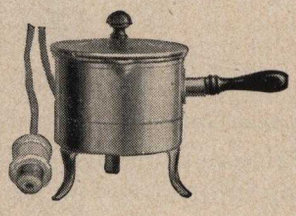
Travelers' Stove

All parts pack within cup which holds 1½ pints. 6 ft. of cord and plug.

No. 1710 250 watts....$5.00

Stove, cup, asbestos mat, cord and plug.





Indispensable Water Cup

Six feet of cord and plug. Cup nickel plated, with safety device that breaks circuit if current is left on until cup boils dry. Cord detachable at cup.

No. 1240 1 Pint 400 watts $5.00
No. 1241 1 Qt. 550 watts 6.50

SIMPLEX ELECTRIC HEATING CO., Cambridge, Mass. Monadnock Bldg., Chicago.

(Continued on next page.)

Simplex Household Irons

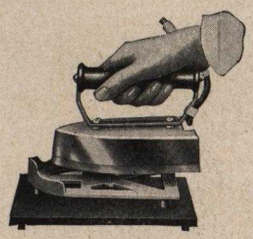
Nickel plated furnished with 6 ft. of cord and lamp socket plug and cast iron stand with slate base.

No. 1502 Travelers' Iron, 2¼x5½ in. bottom, weight 3 lbs. 200 watts $4.50

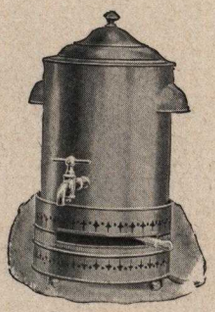
No. 1502B Sewing room iron, 3x-5¾ in. bottom, weight 4 lbs. 280 watts $5.00

No. 1502C Household Iron, 3⅝x6 in. bottom, weight 5 lbs. 400 watts $6.00

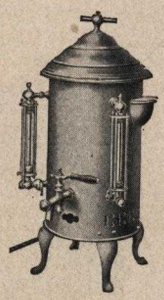
No. 1502D Laundry Iron, 3¾x6¼ in. bottom, weight 6 lbs. 450 watts $6.50



No. 1502B



No. 1461



No. 412

Simplex Coffee and Hot Water Urns

Jacketed Urns.

These urns are of the best possible finish and workmanship, are heavy copper, nickel plated, double tinned inside, have double walls and cover, with three-quarter inch space filled with best wool felt and perfectly sealed.

They are well suited for use as coffee or tea urns, and the very small amount of heat required to keep water hot makes the cost of operating cheaper than with gas under usual conditions. For long periods of service each day, these urns are much to be preferred.

No.		Watts Min.	Watts Max.	Price
1461	Urn. Plain. One gallon. Three heat. Switch and six feet of cord; no plug.	100	500	$23 00
1462	Urn. With gauge glass. One gallon. Three heat. Switch and six feet of cord; no plug	100	500	25 00
1463	Urn. Plain. Two gallons. Three heat. Switch and six feet of cord; no plug..	125	800	29 00
1464	Urn. With gauge glass. Two gallons. Three heat. Switch and six feet of cord; no plug	125	800	31 00
1465	Urn. With gauge glass and tumbler top. Two gallons. Three heat. Switch and six feet of cord; no plug.....	125	800	33 00

Jacketed Urn with Stoneware Vessel.

Coffee Urns are made with stoneware crocks for holding the coffee; these are surrounded with water in which is placed the electric heater. All outer parts of the urn are of copper tinned inside and well finished nickel plate outside. The urns are provided with gauge glasses showing both the amount of water and coffee. Heaters have three heats controlled by a plug switch. The plug is connected to cord on the urn. Receptacle for the plug connects to circuit. All urns, in common with other articles using more than 500 watts, must not be connected to lamp sockets.

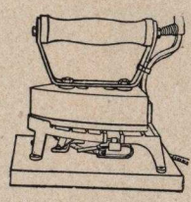
No.		Watts Min.	Watts Max.	Price
412	Coffee Urn. Two gallon stoneware vessel for coffee. Three heats. Four feet cord. Plug switch	350	1400	$51 00
413	Coffee Urn. Three gallons. Same	425	1700	58 50
414	Coffee Urn. Four gallons. Same	525	2100	65 00
415	Coffee Urn. Five gallons. Same.....	625	2500	74 00

Simplex Laundry and Tailors' Irons

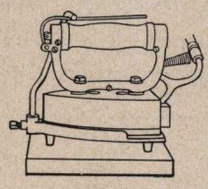
125 and 250 volts. Approved Aug. 6, '07.

With plain stand. With Automatic Regulator Stand reduces current when iron is not in use. Automatic Handle Switch (cuts off current unless iron is properly placed on stand) and Automatic Regulator Stand and Handle Switch (combining both devices for economy and safety.

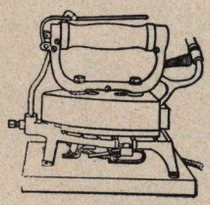
All the usual weights, sizes and shapes of Laundry Irons can be had. Plain, Diamond and Morocco Face. On account of the many sizes and weights we show types only. Specific information in Simplex Catalog.



Iron with Automatic Regulator Stand

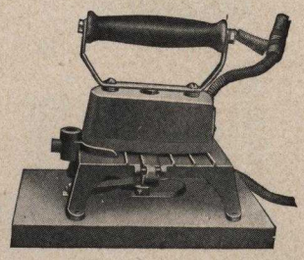


Iron with Automatic Handle Switch

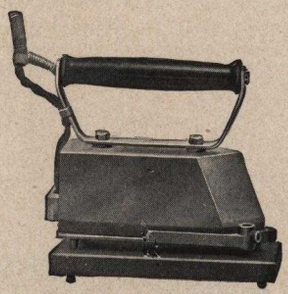


Regulator stand and Handle Switch

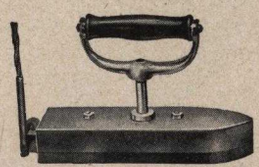
Smoothing Irons, Round or Pointed Nose. All weights



Polishing Irons, Round Nose, Pointed Nose, Diamond and Morocco Face



Tailors Goose. All weights Diamond Nose, Oval Nose and Special Broad Face



No. 1806 Tailors' Machine Iron. Furnished to fit standard machines. With Hand Regulator or Automatic Regulator. See Catalog.

No. 1431

Simplex Sterilizers

No. 1431 Dentists', 350 watts $10.00

No. 1432 Dentists', 500 watts $12.00

No. 1434 Surgeons', 800 watts $14.00

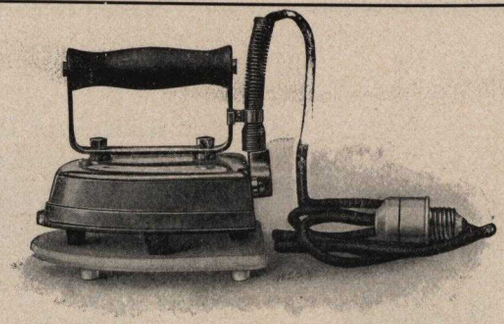
SIMPLEX ELECTRIC HEATING CO., Cambridge, Mass. Monadnock Bldg., Chicago.

HEATERS, ELECTRIC.—(Continued).

"Barr" Electric Pressing Irons. Cat. No. 9216. Type 2-A., 4.8 A., 110-V., together with the Barr stands for these irons.

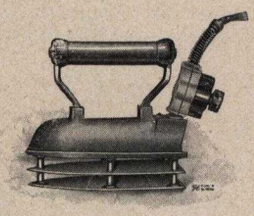
Approved Aug. 6, '07.

W. J. BARR ELECTRIC CO., Cleveland, O.



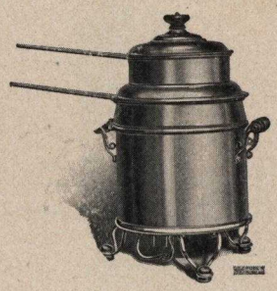
Westinghouse Electric Pressing Irons, 100-125 volts, 5, 7 and 9 lb. sizes. Style Nos. 102703-102705 incl., 102708-102710 incl., and 102713-102715 incl. Equipped with N. E. Code Standard Heater Cord, separable cap attachment plugs and stand. Approved July 30, '08.

WESTINGHOUSE ELECTRIC & MFG. CO., Pittsburg, Pa.



Flat Iron

Chafing Dish.



Water Heater

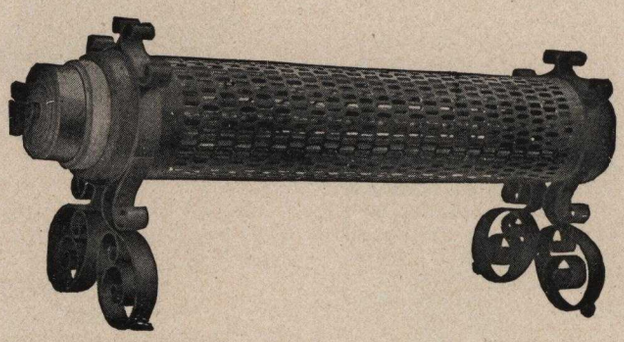
Luminous Radiator.

G. E. Pressing Irons, Type F, 95 to 250 V. Three, six eight, twelve, fifteen, eighteen and twenty-four pound sizes, supplied with approved attachment plugs, cord and G. E. stands. Cat. Nos. 38123-38125 incl., 47354, 47355, 36814-36816 incl., 48058-48062 incl., 40806 and 43481, 39921-39923 incl., 40805, 43482, 75109-75139 incl., 45320-45324 incl., 47356-47370 incl.

Also G. E. Heaters, 95-250 V., with Cartridge Type Heating Units. Broilers, Nos. 40815, 40816, 38654, 43489 and 43490. Disc Stoves, Nos. 43483-43488, 40811-40814, 38651-38653, 76616 and 76617. Grids, Nos. 40328-40330, 43491 and 43492. Glue Pots, Nos. 43497-43500, 47395-47398, 48424-48428, 48331, 47403, 47404, 43503, 43504. Luminous Radiators, Nos. 42176-42182, 76639-76646, and 43548. Tubular Air Heaters, Wall and Floor Types, Nos. 75204-75233, and 75244-75273. Approved June 1, '08.

Also G. E. Heaters, 95-250 V., with Quartz Enamel Heating Units. Chafing Dishes, Nos. 39520, 42392, 42393, 42670 and 42671. Coffee Percolators, Nos. 42665-42669, 39744, 42390, 42391, 43279 and 43280. Combination Cookers, Nos. 42863-42866, 43275-43278, 47109-47113, 45299-45308, 39759 and 41239. Corn Poppers, Nos. 45027-45031. Disc Stoves, Nos. 45032-45036. Frying Pans, Nos. 42672-42677, 42394-42397, 39521, 39522, 39745, 43281, 43282. Shaving Cups, Nos. 44303 and 45026. Water Heaters, Nos. 42654-42664, 45310-45314, 42384-42389, 45294-45298, 39518, 39519, 43269, 43270, 43273, 43274, 39742 and 39743. Tea Kettles, Nos. 45274-45283. Approved May 29, '08.

GENERAL ELECTRIC CO., Schenectady, N. Y.



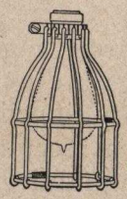
Johns-Manville, Type H., Heater No. 1, 110 V. A group of heat coils encased with perforated sheet metal and supported on iron legs. Supplied with regulating switch and approved heater cord for portables, for use on circuits supplying up to 5000 watts. Approved Feb. 18, '07.

H. W. JOHNS-MANVILLE CO., New York, N. Y.

LAMP GUARDS—(Continued).

"Never Break" Guards and Nets.

No. C, etc.



No. 1, etc.

No. 5A, etc.

No. 65, etc

No. 107, etc.

No. 130, etc.

No. 161, etc.

No. 170, etc.

No. 240, etc.

Nos. C. 1, 5 A., 65, 107, 130, 161, 165 A, 170 and 240 are for 8, 16, or 32 c. p. incandescent lamps.

No. 13, etc.

Nos. 13, 205 and 225, with reflectors, for 16 and 32 c. p. lamps.

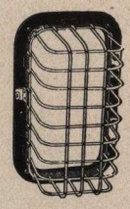
No. 205, etc

No. 225, etc.

No. 115, etc.

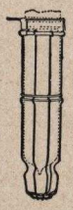
No. 115, with wire netting, for 16 and 32 c. p. lamps.

No. 50, etc.



No. 54, etc.

Nos. 50 and 54 for 16 and 32 c. p. lamps, for gymnasiums, etc.



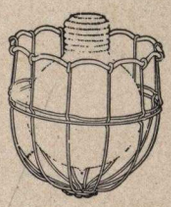
No. 100.

No. 100 for Bung Hole Guard

No. 99 for tubular lamp.

No. 150, etc.

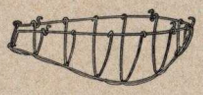
No. 150, etc. for Meridian lamps.



No. 42.

No. 140.

Nos. 42 and 140 for 16 and 32 c. p. lamps. Used with shade holders.



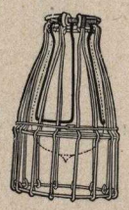
No. 24.

No. 91, etc.

Nos. 24 and 91, used with tin shades.

No. 69. Miniature Portable.

No. 30 For Table and Bench Work.



No. 165 A, etc.

No. 70

No. 74

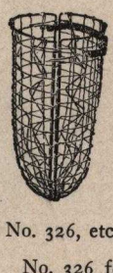
No. 76

No. 79

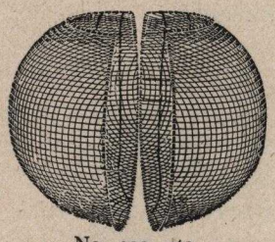
Nos. 70, 74, 76 and 79 for 16 and 32 c. p. lamps.

No. 250 For Factory and Machine Shops.

No. 80 for tubular lamp.

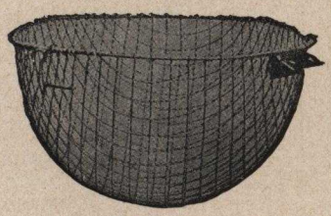


No. 326, etc.

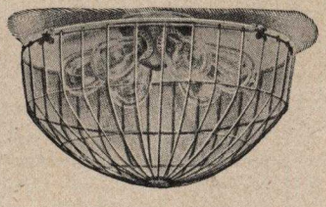


No. 300, etc.

No. 326 for Inside Arc Globes; No. 300 for Outside Arc Globes.

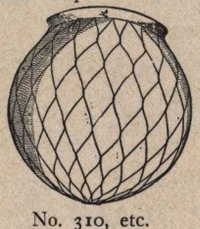


No. 82, etc.

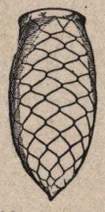


No. 182, etc.

Nos. 82 and 182 for Clusters. Made 10 to 24 inch diameter.



No. 310, etc.



No. 320.

Nos. 310 and 320 nets for inside and outside Arc Globes.

No. 330, etc. Nets for Meridian lamps.

"Never Break" Guards and Nets.

Manufactured by
HAMBLIN & RUSSELL MFG. CO.,
Worcester, Mass.

Selling Agent:
FRANK W. MORSE,
516 Atlantic Ave., Boston, Mass.

LAMP GUARDS.

The "Keystone" Portable Lamp Guard

Consists of two portions, the cage with hook and handle that carries the socket. The cage is made of bessemer steel wire, riveted to the malleable iron ring that forms the bottom of the cage. Cross rings are both clamped and soldered. Entire cage is carefully tinned.

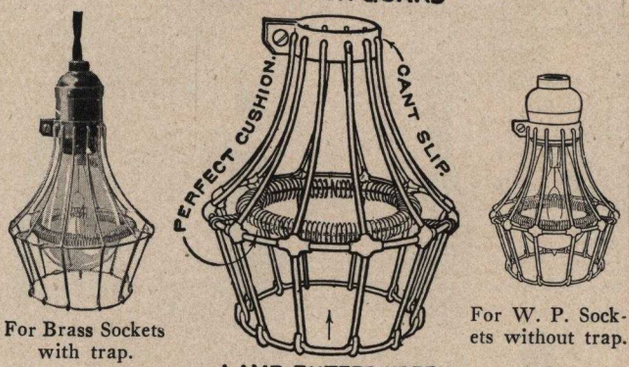
The inner end of the handle has a receptacle for the socket and a large chamber below to permit knotting the wires, thus avoiding strains on the socket.

The socket is of porcelain and is held rigidly in place by two metal spring clamps. Well insulated. Made for either 16 or 32 c. p. lamps.

Approved March 10, '08. Write for circular No. 611.

ELECTRIC SERVICE SUPPLIES CO.,
Philadelphia Chicago Keokuk, Ia.

"HOLD FAST."
IT FASTENS ON THE SOCKET.
"ALWAYS ON GUARD"



For Brass Sockets with trap.

For W. P. Sockets without trap.

LAMP ENTERS HERE.
QUICK ACTION.—POSITIVE RESULTS.

Patented Aug. 15, 1905. Approved Mar. 4, 1907.

Perfectly Protects Lamp.

The manufacturers of the "Holdfast" assert that it is the only lamp guard that can be slammed against a solid wall without breaking the lamp. They offer to send a guard for trial, free, and pay for the lamp if broken.

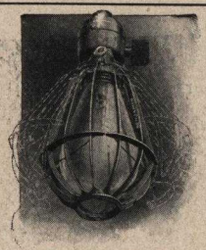
The construction of the "Holdfast" prevents inflammable matter from coming nearer than one inch to the lamp.

Made in four weights of wire and to fit lamps from 4 to 50 candle power.

Carried by all Electrical Jobbers.

Manufactured only by

THE HOLDFAST LAMP GUARD CO.,
W. N. Matthews & Bro., Mgrs.,
222 N. 2d St., St. Louis, Mo.

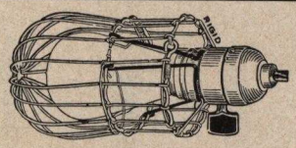


Cat. No. 160 Cat. No. 160-P

"Benjamin" for 16 c. p. lamps. Cat. No. 160-P, portable guard; wooden handle with fibre cage, for use only in dry places.

Cat. No. 160, metal lamp guard in two parts, hinged at top to allow ready insertion or withdrawal of lamp. Approved July 21, '08.

BENJAMIN ELEC. MFG., CO., Chicago, Ill.



Protector H. Iron Wire Guard for 16 and 32 c. p. lamps. Fits any make of brass socket. No shade holder required. Approved Aug. 2, '07.

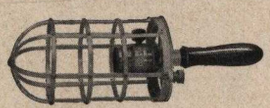
CRESCENT COMPANY,
103 West Adams St., Chicago, Ill.

"Hubbell," Cat. No. 5485, for 16 C. P. lamps, and Cat. No. 5487 for 32 C. P. lamps. Approved June 18, '07.

HARVEY HUBBELL, INC.,
Bridgeport, Conn.

"Standard" adjustable lamp guard, with or without spiral safety cushion. Approved Apr. 28, '08.

STANDARD WIRE CO.,
New Castle, Pa.



Cat No. 25701.

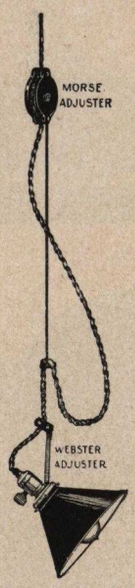
G. E. Portable. Cat. No. 25701, with steel wire guard and key socket No. 9386, for Edison screw base lamps; Cat. No. 42681, with keyless socket No. 32440 exfra heavy steel ribbon guard. Approved May 4, '07. Std. pkg. 25.

GENERAL ELECTRIC CO.,
Schenectady, N. Y.

Cat. No. 42681.

APPROVED ELECTRICAL MATERIAL

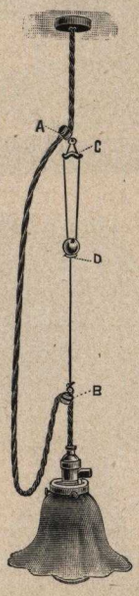
LAMP ADJUSTERS, LAMP ADAPTERS AND CURRENT TAPS.



Morse Cord Adjuster. Enables one to raise or lower a suspended lamp with one hand. Stops anywhere. It can be attached, without any extra expense, to any twisted or cable cord.

Webster Lamp Adjuster. With it you can adjust the lamp and reflector at any angle perpendicularly or horizontally, so that its light can be reflected in any direction. It can be attached without extra expense to any twisted or reinforced cord.

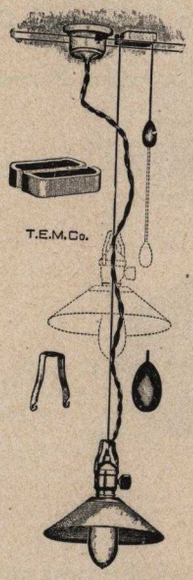
FRANK W. MORSE, Boston, Mass.



Approved Aug. 21, '06

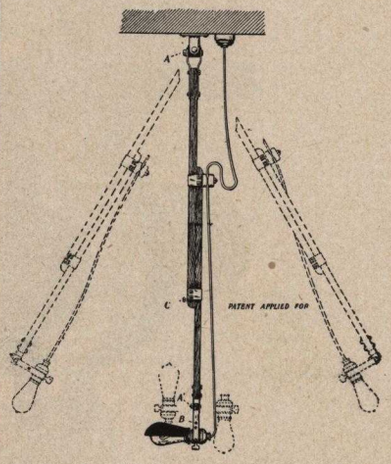
Innovate. A device consisting of cord and weighted ball to be secured to pendant or reinforced cord by clamps.

CRESCENT CO.,
Valparaiso, Ind.



"Ideal." A cord running in a groove in special porcelain ceiling block and at one end supporting single lamp socket by action of a weight hanging from other end of cord. Approved April 9, '07.

TRUMBULL ELEC. MFG. CO.,
Plainville, Conn.



Universal Electric Light Holder. Eight sizes 3 ft. to 14 ft. 6 in. Black, oxidized or nickel plated finish.

Approved only when equipped with reinforced cord. See rule 45f. Approved April 30, '06.

GAIL-WEBB MFG. CO.,
Buffalo, N. Y.

"Eclipse." Mechanical system consisting of a small rope passing over a fixed and movable pulley and arranged to support an incandescent lamp. Approved Sept. 19, '07.
(Cut not available.)

J. W. CARTER, Abilene, Texas.

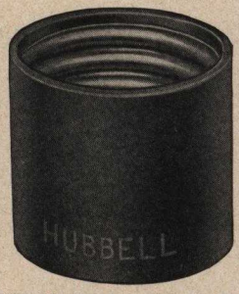
"Gem" Lamp Adjusters, styles A and B. A pulley wheel mounted in iron bracket; wheel controlled by locking mechanism so as to permit the adjustment of a pendant lamp hung from porcelain knob secured to device. Approved Apr. 13, '08.

THE GEM MFG. CO., Milwaukee, Wis.

LAMP ADAPTERS.

Bryant Adapter for Edison base lamps in T. H. Sockets and receptacles. Cat. No. 9357. Approved June 17, '08.

BRYANT ELECTRIC CO.,
Bridgeport, Conn.



"Hubbell" Adapter for Edison base lamps in T. H. sockets and receptacles. Cat. No. 5472, 3 A., 250 V. Approved Feb. 10. '08.

HARVEY HUBBELL, INC
Bridgeport, Conn.

"Marshall" Adapter for Edison base lamps in T. H. sockets and receptacles. Cat. No. 9357. 3 A.. 250 V. Approved Nov. 25. '07.

MARSHALL ELECTRIC MFG. CO., Boston, Mass.

"G. E." Cat. No. 35699 for candelabra base lamps to Edison base sockets. ½ A. 125 V. Approved July 21. '06.

GENERAL ELECTRIC CO.,
Schenectady, N. Y.

CURRENT TAPS.

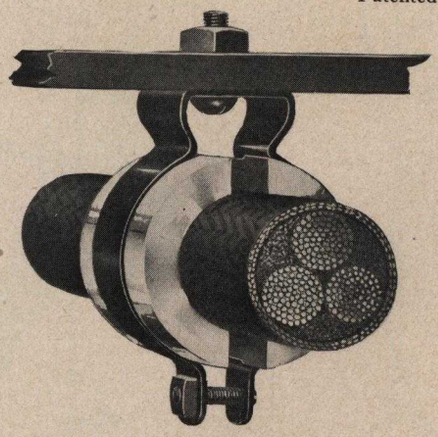
"Benjamin" series circuit current tap, Cat. No. 95½, 3 A., 250 V. By means of the rotating sleeve, it can be fixed in any position without turning the device, and the cord consequently led out at any angle. Standard finish is polished brass, but any finish may be made to correspond with the fixtures.

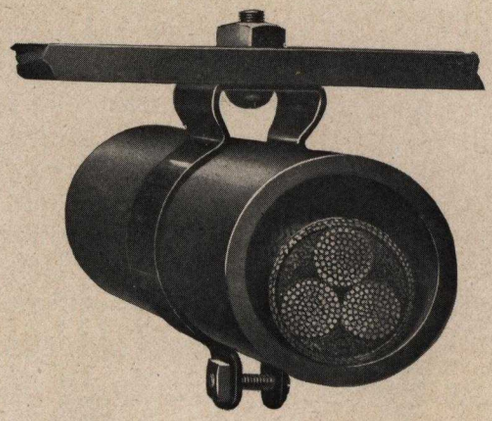
Approved Feb. 12, '08. Std. pkg. 50.

BENJAMIN ELECTRIC MFG. CO., 42 West Jackson Blvd., Chicago, Ill.

Minerallac Cable and Conduit Hangers and Cleats.

Patented November 1, 1904, No. 773710.





These hangers are made of the best spring steel and are much stronger than cast iron hangers for the same purpose.

They are easily and quickly put in place, and open wiring, conduit and cable may be run with greater rapidity and more compactly arranged than by the use of any other hanger.

These hangers have been approved by the Underwriter's National Electrical Association for use on circuits up to 300 Volts when mounted direct on the surface wired over. For voltages from 300 to 550 Volts these hangers must be installed with spacers under the base of the hanger or mounted on metal racks or brackets so as to hold the conductors at least 1 in. from the surface wired over. For voltages above 550 Volts the hangers should be used with an appropriate insulating bushing having necessary insulation and dielectric strength, the hangers being mounted on metal racks or brackets to hold the conductors far enough from the surface wired over to preserve the required electrical clearance.

We are prepared to furnish all styles of bushings for high tension work properly designed to get the necessary insulation and dielectric and mechanical strength.

We shall be pleased to submit designs and prices to conform with your requirements.

These hangers may be attached to steel, wood or tile by the use of bolts, screws or trunnion nut toggle-bolts respectively.

For rubber covered and weather-proof cable porcelain bushings are furnished.

Price List Cable and Conduit Hangers

Size of Cat. No.	Diameter of Opening Min.	Diameter of Opening Max.	Size of 250 V Lead Covered Cable or Lorricated Conduit	Approx. Wgt. per 100	List Price per 100
0	5/8 in.	27/32 in.	3c No. 14 to 7c No. 14 or ½ in. Conduit	4 lbs.	$3.45
1	7/8 in.	1 1/16 in.	No. 1 to 2/0 or ¾ in. Conduit	4½ lbs.	3.80
1½	1 in.	1 3/16 in.	No. 2/0 to 4/0 or ¾ in. Conduit	4½ lbs.	3.80
2	1¼ in.	1 15/32 in.	No. 4-0 to 300 M. or 1 in. Conduit	6½ lbs.	5.45
3	1½ in.	1 23/32 in.	500 M. to 750 M. or 1¼ in. Conduit	7 lbs.	5.45
4	1¾ in.	1 31/32 in.	800 M. to 1,125 M. or 1½ in. Conduit	12 lbs.	6.75
5	2 in.	2 15/32 in.	1,500 M or 2 in. Conduit	13 lbs.	7.25
6	2½ in.	3 in.	2,000 M. (3/c 4-0*) or 2½ in. Conduit	24½ lbs.	8.10

Above prices do not include stove bolts.

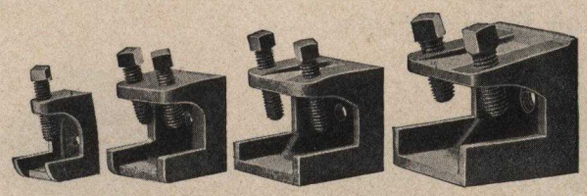
All sizes Trunnion Nut Toggle Bolts kept in stock.

Prices on application.

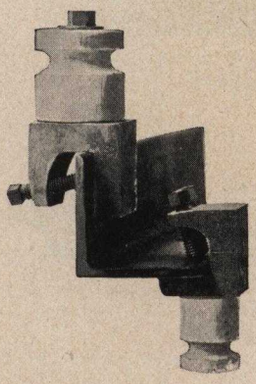
Price List Porcelain Bushings.

Size of Cat. No.	Diameter of Opening Min.	Diameter of Opening Max.	Size of Rubber Covered Cable 250 V	Approx. Wgt. Per 100	Price List Per 100
1	5/16 in.	19/32 in.	8-2/0	8 lbs.	$5.25
2	5/8 in.	27/32 in.	3/0—4/0	12 lbs.	6.00
3	7/8 in.	1 3/32 in.	250 M.— 450 M.	13 lbs.	6.60
4	1⅛ in.	1 9/32 in.	500 M.— 700 M.	22 lbs.	7.65
5	1 5/16 in.	1½ in.	750 M.—1000 M.	27 lbs.	8.50
6	1 17/32 in.	2 in.	1125 M.—2500 M.	32 lbs.	9.25

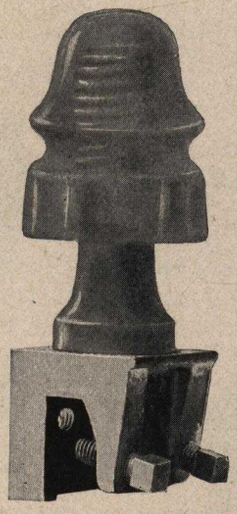
MINERALLAC COMPANY, 839 Monadnock Bldg., Chicago, U. S. A.



1 in. 1½ in. 2 in. 2½ in.



Showing 2 in. and 1½ in. style insulators appled to angle iron.



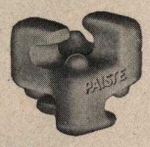
Showing 2½ in. style with glass insulator pin.

"Universal" Insulating Supports. Malleable iron clamps to be mounted on steel beams in building to which porcelain insulators may be attached. Four sizes, 1 in., 1½ in., 2 in., and 2½ in. for all sizes of porcelain and glass insulators. 1 in. size, std. pkg., 200; 1½ in. size, std. pkg., 100; 2 in. size, std. pkg., 50; 2½ in. size, std. pkg., 25. Approved Oct. 31, '07.

STEEL CITY ELECTRIC CO., Pittsburg, Pa.

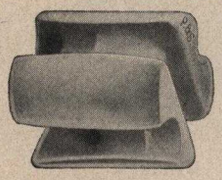
Cutter Insulating Ceiling Hook. "Why," Cat. No. 408, for arc lamps and small motors. Strongly made of malleable iron and porcelain. Price $0.25. Approved July 21, 1908.

GEORGE CUTTER CO., South Bend, Ind.



"Paiste" Cross-over Insulator. Cat. No. 5212. A small one-piece porcelain device having opposed projecting pairs of lugs, designed to be used instead of tubes when wires are run crossing at right angles to each other. Approved Oct. 31, '07.

H. T. PAISTE CO., Philadelphia, Pa.



Cat. No. 8.

"P. & S.." Strain Insulators. Cat. No. 8, glazed, for ⅜ in. wire. Std. pkg. 500. Cat. No. 9, glazed for ½ in. wire. Std. pkg. 300. Approved Oct. 31, '06.

PASS & SEYMOUR, INC., Solvay, N. Y.

INSULATING PAINT.

W. P. Insulating Black, Nos. 1 and 2. Approved Oct. 1, '06.

STANDARD VARNISH WORKS, New York, N. Y.

INSULATING MATERIAL.

Peru Black Glazed Porcelain for electrical fittings. Approved Aug. 2, '07.

PERU ELECTRIC MFG. CO., Peru, Ind.

Material for Socket Keys. Approved Nov. 17, 1905.

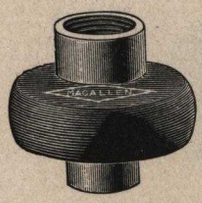
SCRANTON BUTTON CO., Scranton, Pa.

Sealing compounds "A," "B," and "C," melting temperatures of which are in excess of 200, 275 and 325° Fahr, respectively.

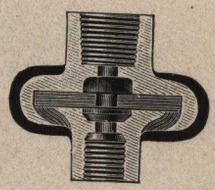
Approved Mch. 27, '06.

INSULATINE CO., New York, N. Y.

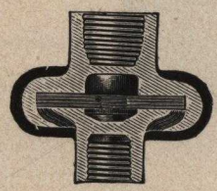
"Macallen" Chandelier and Bracket Joints.



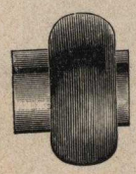
Chandelier Size Joint.



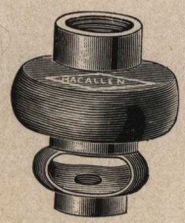
Section of Combination Joint.



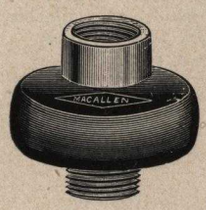
Section of Blank Combination Joint



Bracket Size Joint



Electrolier or Separable Joint.



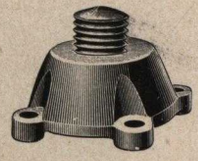
Male and Female Joint.

Insulated Eyes.

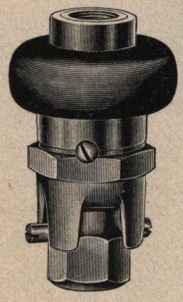
TRADE MACALLEN MARK.

Registered July 31, 1894.
Re-registered, July, 4, 1905.

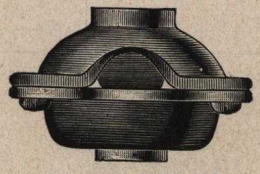
Insulated Hook.



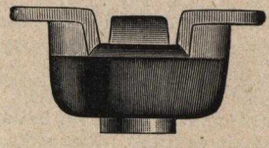
Insulated Fixture Stud.



Insulated Ball and Socket Joint.



Separable Electrolier Tripod Joint for Conduits.

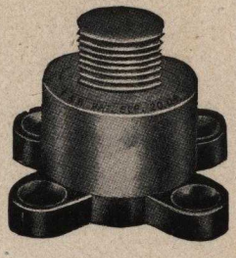


Insulated Crowfoot.

Approved May 7, '07.

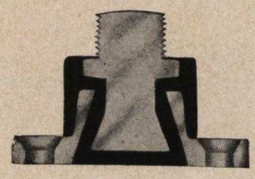
THE MACALLEN COMPANY, Foundry & Division Sts., Boston, Mass.

"T. & B." Insulating Stud.



This is a four prong malleable iron insulating stud for straight electric fixtures. 1⅜ in. high, and may be used with any style of canopy or with fixtures with flat backs.

Approved Sept. 26, 1906.



List Prices.	Std.Pkg.	List Price Per 100
⅜" Insulated Stud	100	$50.00
¼ x ⅜" Hickeys	100	10.00
⅜ x ⅜" Hickeys	100	10.00

Approved Sept. 26, 1906.

THOMAS & BETTS CO., 229 Broadway, New York, N. Y.

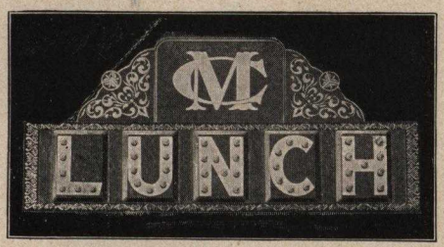
MEASURING INSTRUMENTS.

Wood Prepayment Meter, 20 A., 220 V. Approved July 13, '05.

FORT WAYNE ELECTRIC WORKS, Fort Wayne, Ind.

Federal Electric Signs.

SECTIONAL LETTER SIGNS.



Sectional Letter Sign with top panel. Patented.

Each letter is enameled on a separate steel plate. The plates are screwed onto a channel iron frame and the wiring is entirely inside the metal case. The porcelain enameled steel surface is absolutely weather-proof and practically indestructible.

No. 108 Panel Sign. Patented.

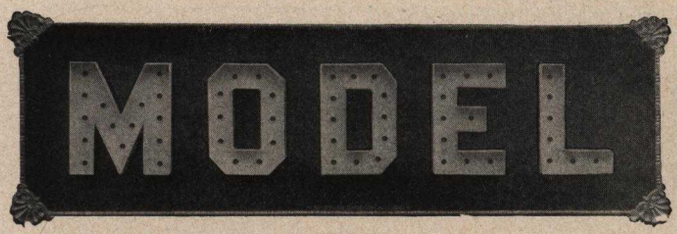
PANEL OR BORDER LIGHT SIGNS.

The frame of the panel signs is all metal and is made in two sections. The wiring is entirely encased in this frame and the joints are lapped and soldered, the whole frame being enameled with three coats of bicycle enamel.

The panels are removable and are made of porcelain enameled steel.

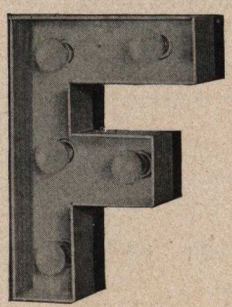
FEDERAL ELECTRIC CO., Lake & Desplaines Sts., Chicago, Ill.

"Haller" Metal Signs.



Standard Grooved Letter Sign.

Standard Raised Letter Sign.

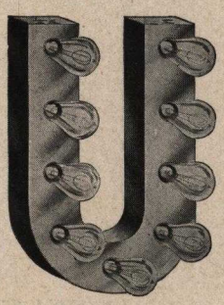


Grooved Box Letter. Plain Block Style. All other styles made to order

Haller Metal Signs and Individual Metal Letters, made of galvanized sheet steel, in any finish desired. The lamp receptacles are concealed in the interior of the letter, lamps being either exposed or concealed in sign body. Any design made to order.

Sketches and quotations furnished on request. In specifications state if you want a single faced or a double faced, a vertical or a horizontal sign. Also give size of letters wanted and maximum length and width of sign. Also give local municipal regulations governing the size of signs, etc.

U. S. Letters Patents: No. 798,676, No. 811,057, No. 811,058, No. 811,059; three others applied for.



Raised Box Letter.

HALLER SIGN WORKS (INC.), 319 S. Clinton St., Chicago.

A. & W. all Metal Signs. "Reflex" Solid Background Letter," "Skeleton Electric Letter Roof" and "Enameled Unit Letter" types. Approved Aug. 20, '08.

A. & W. ELECTRIC SIGN CO., Prospect & W. 3rd St., Cleveland, O.

Talking Sign (formerly Mason Monogram). Approved Oct. 9, '07.

THE ELECTRIC MOTOR & EQUIPMENT CO., Newark, N. J.

Colonial Signs. Porcelain letters to be mounted on suitable supporting frames. Approved Sept. 10, '07.

COLONIAL SIGN & INSULATOR CO., Akron, Ohio.

"Mobile" Changeable. Galvanized iron grids supported on porcelain blocks in galvanized iron frame. Sliding Edison lamp socket. Approved June 29, '06.

FEDERAL ELECTRIC SIGN SYSTEM, New York, N. Y.

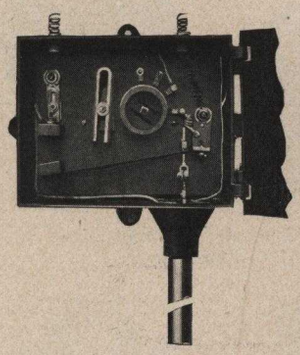
N. B. Universal Monogram Signs. Metal frames carrying by means of slate strips, two plates in which are mounted lamp holders. Changeable face plates. Approved Feb. 12, '08.

ELECTRIC CARRIAGE CALL CO., New York, N. Y.

Panel and raised letter metal signs of standard patterns. Approved Oct. 21, '07.

METROPOLITAN ENGINEERING CO., New York, N. Y.

TYPE "J" Motorless Flasher and "Skedoodle" Plug.



Type "J" Motorless Flasher

TYPE "J" Motorless Flasher is equipped with carbon contacts and magnetic break. It is operated by a thermal element contained in conduit pipe extension. All of the working parts are enclosed in a cast iron box.

It is made single and double circuit, 10, 15, 20 and 25 amperes, for any voltage from 100 to 125 direct or alternating current.

This flasher has nothing to oil or wind up. When once adjusted, it will run for months without attention. Approved Feb. 29, 1908.

Skedoodle Plug.

THE "SKEDOODLE" PLUG fits any ordinary socket and holds a common lamp. It flashes the lamp on and off many times a minute. Each plug is complete in itself and independent of every other socket. It is made in 4, 8 and 16 c. p. 100-125 V. and 200 to 250 V

No wiring is necessary and anyone can put it in place. In small show-cases, show windows, illuminated signs, street fair decorations, stage effects, bull's-eye and drum signs, color changing effects, it is quickly installed and easily maintained.

Approved July 31, 1906.

ELECTRO-AD COMPANY, 54 State St., Detroit, Mich.

DECORATIVE LIGHTING.

G. E. Christmas Tree Lighting Outfit. 125 V.
Approved Nov. 2, '08.
GENERAL ELECTRIC CO., Schenectady, N. Y.

"Jaeger" Christmas Tree Lighting Outfit. 125 V.
Approved Nov. 2, '08.
JAEGER MINATURE LAMP MFG. CO., New York, N. Y.

TRANSFORMERS, BELL RINGING.

"Rollinson" Bell Ringer, 110-120 V., a. c. circuits, supplying secondary voltages of 6; 6, 12 or 18; 6, 16 or 24 respectively when wiring of primary is installed in accordance with Class C. N. E. Code.

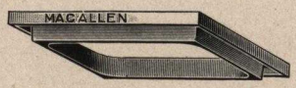
Approved Feb. 4, '07.

MOHAWK ELECTRIC CO., Schnectady, N. Y.

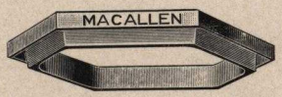
CANOPY INSULATORS.

Macallen Canopy Insulators.

Round Canopy Insulator.



Square Canopy Insulator.



Horizontal Canopy Insulator.

"Macallen" furnished in white or standard brown compound, thoroughly water-proof, strong, durable and of the highest insulating qualities.

They are designed to go between the canopy and wall or ceiling, where combination or straight electric fixtures are installed in buildings that are constructed with metallic lathing, or where there are metal ceilings or walls used.

Old Style or Double Groove Insulator.

These Insulators are furnished only when specially required.

Approved Dec. 12, 1904.

THE MACALLEN COMPANY, Foundry & Division Sts., Boston, Mass.

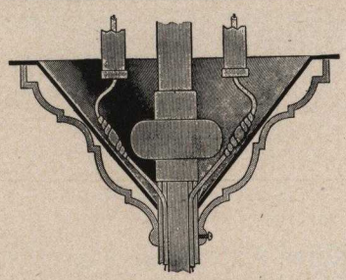
G. E. Fibre ring ⅛-inch thickness securely riveted to fixture canopy so as to provide a separation of 3/16-inch between canopy and ceiling. Appproved Nov. 4, '05.

(Cut notavailable).

GENERAL ELECTRIC COMPANY, Schenectady, N. Y.

Fibre ring ⅛ in. thickness, securely riveted to fixture canopy, so as to give 3/16 in. insulation between canopy edge and wall or ceiling. Approved July 12, '05.

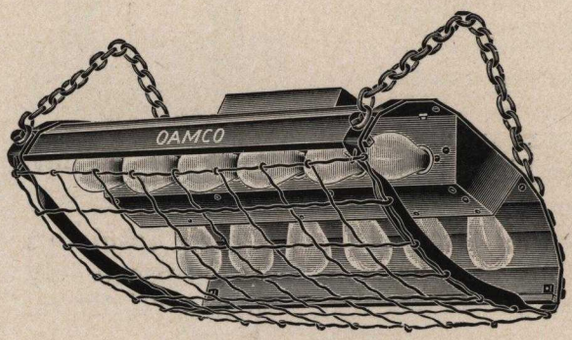
MITCHELL VANCE CO., New York, N. Y.



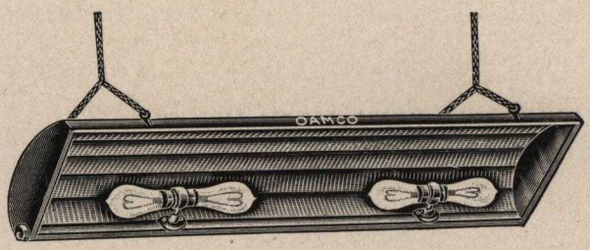
"Young" Funnel shaped, one piece, made either of micanite or porcelain. Approved Oct. 1, '06.

MICA INSULATOR CO., New York, N. Y.

"Oamco" Theatre Border and Show Window Reflectors.



Style No. 591.
Theatre Border Reflector.

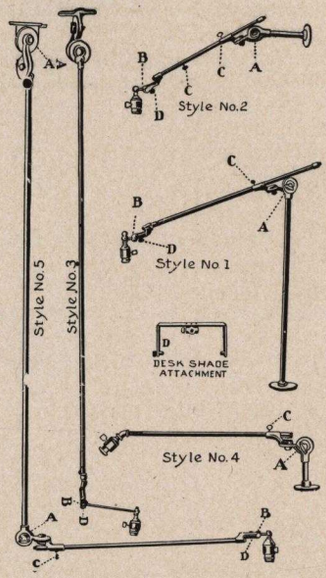


Style No. 655A.
Snow Window Reflectors.

A most complete line of Reflectors made for all kinds of purposes will be found in our "Book of Electrical Specialties." Sent on application. Approved Apr. 13 and Aug. 31, '08.

OVERBAGH & AYRES MFG. CO.,
Manufacturers.
232-234 South Clinton St., Chicago, Ill.

Morse Adjustable Fixtures.

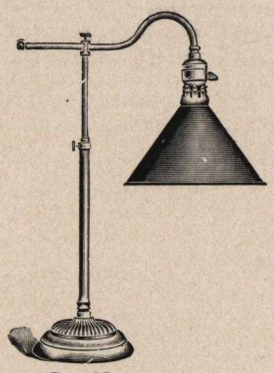


MORSE ADJUSTABLE FIXTURES are made in five styles and are low in price, simple in construction, strong in make, and have a complete adjustment. They are especially adapted for factories, shops and draughting rooms.

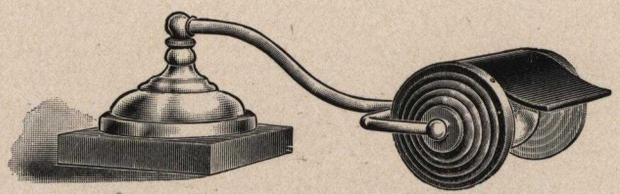
FRANK W. MORSE,
516 Atlantic Ave., Boston Mass.

Faries Portable Fixtures.

Cat. No. 30.
Height 14 to 18 inches.



Cat. No. 23.
Height 14 to 24 inches.
10-inch arm.

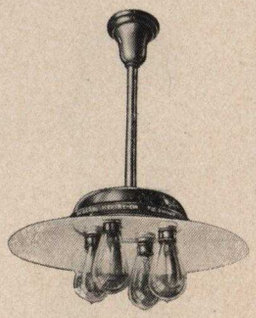


Cat. No. 827. Swinging Portable or Desk Bracket, with slate base.

"Faries" portable fixtures, equipped with approved re-inforced portable cord and separable cap attachment plugs. Cat. Nos. 14, 23, 30, 63, 64, 152, 153, 827, 1012, 1052 and 1842. Approved March 10, '08.

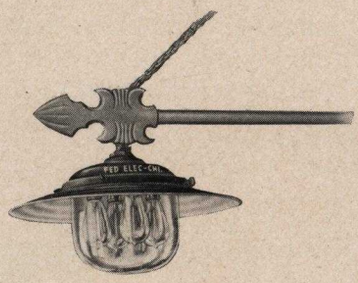
FARIES MANUFACTURING CO., Decatur, Ill.

Federal Clusters for Tungsten and Other Lamps.



No. 752.
A neat, compact and inexpensive cluster for store lighting in competition with gas arcs. Made with 18 inch and 20 incn shades, 2 to 4 light.

No. 501.
A more elaborate fixture for halls, restaurants and offices. For any size lamp. Made with 15, 20 and 25 and 30 inch band, with 4 to 11 lights.

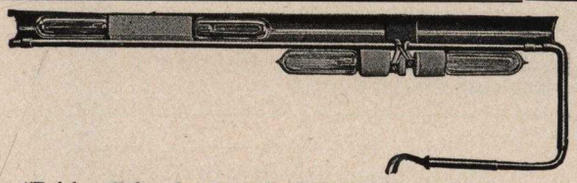


No. 778.
A Porcelain Enameled steel outdoor cluster unsurpassed by any on the market. Made for 2, 3 and 4 lights, 100 watt size or smaller.

No. 751.
A moderate priced cluster for use with Holophane shades for stores and offices. Made for 4, 5 and 6 lights, with 20 inch shade. Smaller similar in style also made.

Many other styles. Write for Bulletin.

FEDERAL ELECTRIC CO., Lake & Desplaines Sts., Chicago, Ill.



"Erickson" for show case and show window use.
Approved Nov. 7, '05.
L. ERICKSON ELECTRIC CO., Boston, Mass.

"Linolite' fixture. Approved for show case, show window, cove and cornice, theatre, and general illumination purposes when installed under conditions satisfactory to Inspection Departments having jurisdiction.
Approved. Mar 20, 1908.
H. W. JOHNS-MANVILLE CO., New York, N. Y.

"Wooden Fixtures" with all interior wiring in metal ducts. Ceiling, bracket and portable types.
Approved July 21, '08.
(Cuts not available.)
A. T. FISCHER CO., Cleveland, Ohio.

"O'Brien" show window and show case reflector and lamp. A tubular 16 c. p. 110 V. lamp mounted on special porcelain sockets in metal frame. Approved Apr. 26, '07.
(Cut not available.)
O'BRIEN ELECTRIC LIGHT CO., Philadelphia, Pa.

"Taussig" show case and wall case reflectors. Metal troughs fitted with standard sockets for incandescent lamps. Wiring in tubes on channels of No. 18 metal. Approved June 19, '07.
(Cuts not available.)
J. TAUSSIG, Chicago, Ill.

"White" adjustable straight electric fixtures, ceiling, wall, bench, table, desk, bracket and portable types.
Approved when wired with approved portable cord having 1/32 inch rubber insulation on each conductor. Approved Sept. 19, '08.
(Cuts not available.)
THE O. C. WHITE COMPANY, Worcester, Mass.

ASBESTOS.

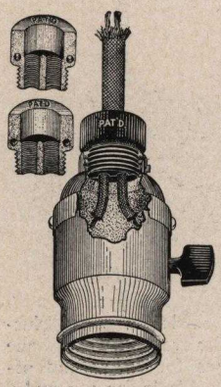
"Plain Asbestos Wood" is the equivalent of ordinary asbestos board. It is a non-absorptive material, but is non-combustible and possesses considerable mechanical strength.
"Oak Asbestos Wood" is similar to Plain Asbestos Wood, with somewhat better non-absorptive and dielectric properties.
"Ebony or Impregnated Asbestos Wood" is similar to above but is better than either in both non-absorptive and dielectric properties.
Approved for barriers in switches, contactors, controllers and other similar devices, and for cabinets, switch and fuse boxes or linings therefor.
Approved March 16, '08.
ASBESTOS WOOD COMPANY, Nashua, N. H.

Carey Asbestos Board.
Approved Sept. 26, '07.
PHILLIP CAREY MFG. CO., Cincinnati, O.

Electrobestos Board, Asbestos Board and Transite Board.
Approved Oct. 24, '04.
H. W. JOHNS-MANVILLE CO., New York, N. Y.

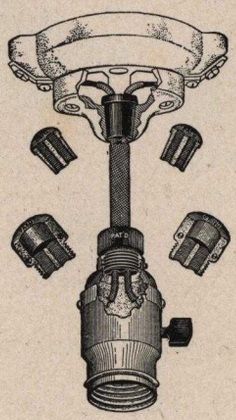
Asbestos Building Lumber.
Approved Dec. 16, '04.
KEASBEY & MATTISON CO., Ambler, Pa.

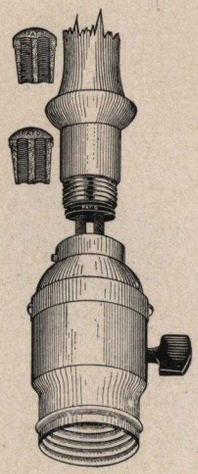
Knostrain Bushings.



⅜″ Socket Bushing.

Knostrain Bushings removes the strain and weight of a suspended socket and lamp from the connections or binding screws both in the socket and rosette and at the same time forms an insulator or bushing.





Rosette or ⅜″ Handle Bushing.

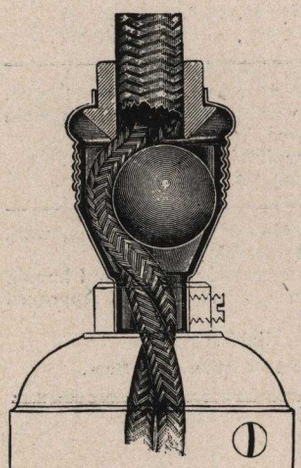
Grips No. 18 or 16
New Code Lamp
or Show Window Cord.

The heavier the weight
the tighter they grip.

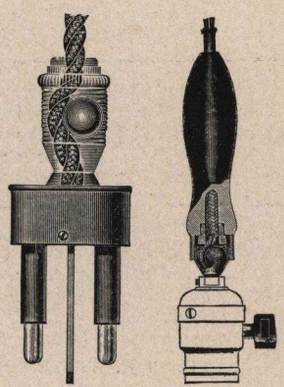
Approved Feb. 7, 1907.

FRANK H. STEWART ELECTRIC CO., 35 North Seventh St., Philadelphia.

The Keough Cord Grip.



Keough Cord Grip.



Black Finish Cord Grip for Receptacle Plug, Conduit, etc.
Cord Grip

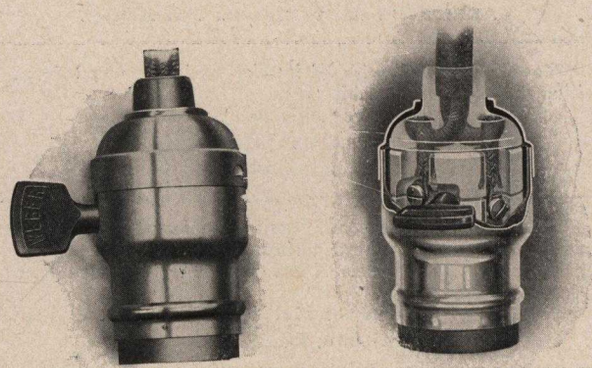
Socket Handle.

This device is for use with every size of cord, either portable or pendant, permitting the use of a ⅛ inch socket with largest size of cord. It securely grips the cord and removes all strain from the binding screws. It can also be used with bracket rosettes, pendant switches, condulets, etc. It is designed to fill the requirements of rule 28, sec. 9.

Approved Sept. 7, 1905.

KEOUGH ELECTRIC CO., Boston, Mass.

Swan Terminal Strain Relief.



Replaces knot in cord in sockets. Designed especially for use with Cord Pendant Construction.

Porcelain as shown in cut, 35 cents list. Regular discounts.

Orders for any Standard Socket also may be placed with this firm and each socket will be equipped with a Fibre Strain Relief at no extra cost. Approved Sept. 10, 1907.

**C. S. KNOWLES, Selling Agent,
7 Arch St., Boston, Mass.**

ELECTRICAL WIRES AND CABLES

Made according to National Electric Code Standard and Special Specifications

Crown Rubber
Lead Encased

Damp Proof Office Wire

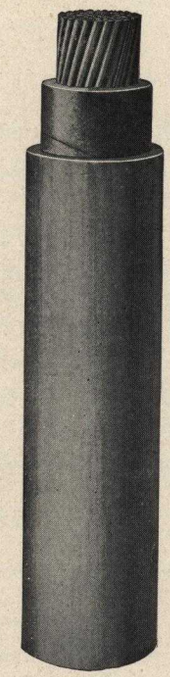
Slow Burning Wire

Reliance Triple Braid Weatherproof

Globe Duplex Rubber Wire

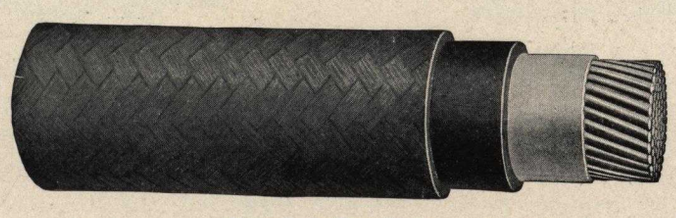
Crown Rubber Wire

Fireproof Covered Crown Wire



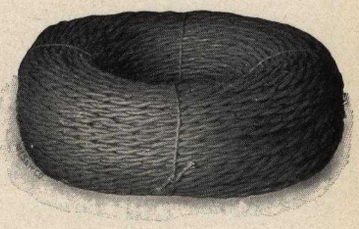
Paper Covered
Lead Encased

Annunciater Wire



Crown Rubber Cables

N. C. Standard Lamp Cord



Lamp Cord

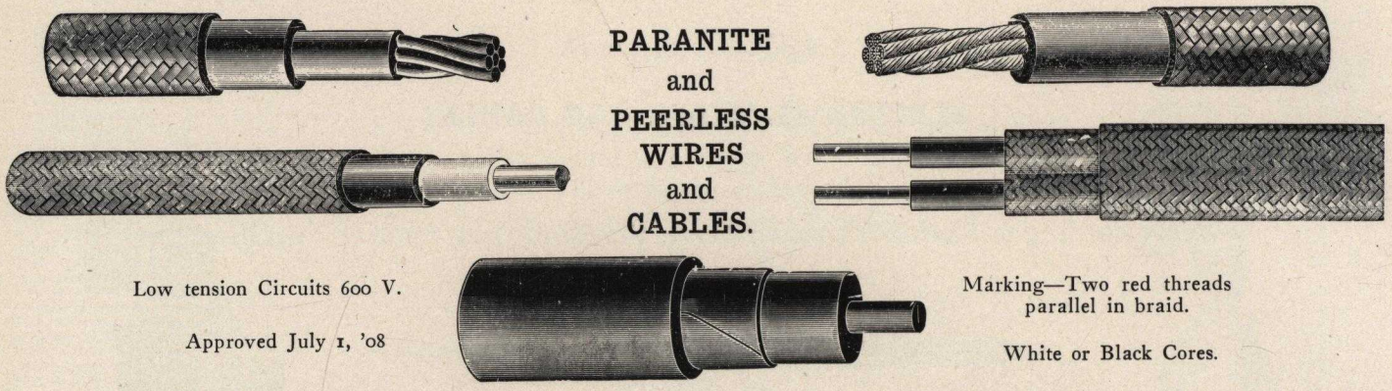
Portable Cords, Stage Cables, Automobile Cables

Magnet Wire

AMERICAN STEEL & WIRE CO.

Chicago **New York** **Worcester** **Denver** **San Francisco**

WIRES—(Continued).



PARANITE and PEERLESS WIRES and CABLES.

Low tension Circuits 600 V.

Approved July 1, '08

Marking—Two red threads parallel in braid.

White or Black Cores.

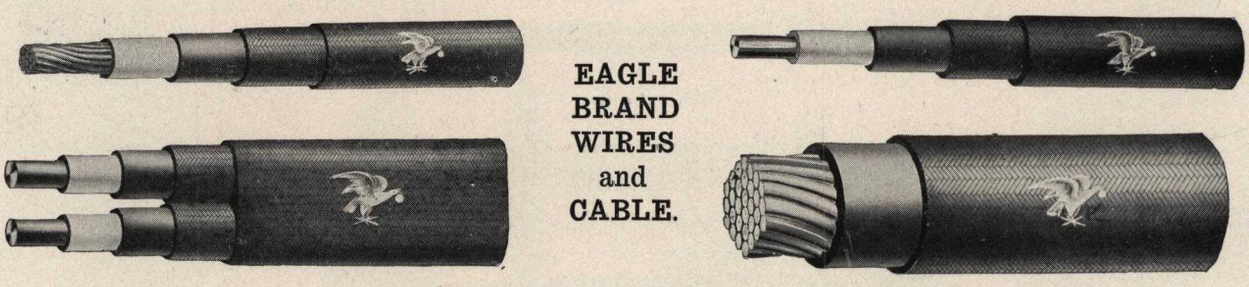
Paranite insulation consists of a white core or a thin coating of pure para rubber over tinned copper wire upon which is placed the standard thickness of black paranite insulation.

Peerless insulation is practically the same except that it is not given the white inner coating.

This company furnishes this wire and cable in single solid conductor, single or double braid, double solid conductor, double braid; Stranded single conductor, single and double braid, stranded extra flexible and single braid, lead covered.

This company also makes a specialty of Armored, Aerial, Submarine, Marine, and high tension wires and cables in both Paranite and Peerless styles of insulation, and a complete line of telephone, telegraph and signal wires and cables of all standard sizes and are prepared to furnish special sizes and insulations on short notice to meet any specifications. A complete catalogue mailed on request.

INDIANA RUBBER & INSULATED WIRE CO., Jonesboro, Ind.



EAGLE BRAND WIRES and CABLE.

Marking: Two green threads crossing in the braid. White or Black cores. Approved July 1, 1904.

This company furnishes the above line of wire in single conductor, single and double braid and leaded; Solid double conductor double braid for conduit work; single conductor stranded, braided, double braided and leaded and stranded, single braid, and braided and leaded circular mill cable, for low tension 600 Volts.

This company also manufactures High Tension cables 600 to 3500 volts in sizes generally used and are also prepared to quote prices and assure prompt delivery of special cables of all kinds and capacities, including underground, marine and submarine wires and cables.

They also carry a complete stock of telephone and telegraph wires and cables, plain single conductors, braided single conductors, plain and braided double conductors and rubber covered iron telephone wire, and twisted pair cables with rubber insulation, braids and lead sheathing made in any number of conductors up to and including 200 conductors No. 19 B. & S. Gauge Copper conductors, but can furnish the same with any size gauge desired on order. Complete catalogue on request.

MARION INSULATED WIRE AND RUBBER CO.,

Chicago Office and Warehouse,
88-90 West Van Buren St.

Main Office and Factory,
Marion, Ind.

WIRES—(Continued.)

Rubber Covered Wire—

Portions of coils not carrying stamps can be distinguished by characteristic markings.

NOTE.—In the markings below, the word "Thread" is used to signify either a single thread, or in some cases, a group of two or more threads woven from a single bobbin.

Acme Rubber Mfg. Co., The, Trenton, N. J.
Marking: Two red threads woven into braid crossing each other.

Bay State Wire & Cable Co., Hyde Park, Mass.
Marking: One black thread running parallel with wire between rubber insulation and the braid. Black core.

Diamond Rubber Co., The, Akron, Ohio.
Marking: One red and one black thread parallel in braid with one red thread crossing.

Okonite Co., Ltd., New York, N. Y.
Marking: Ridge on rubber insulation. Black core.

American Electrical Works, Providence, R. I.
Marking: Three red threads woven parallel in braid. Black core.

American Steel and Wire Co., Worcester, Mass.
Marking: Soft woolen thread embdded in rubber lengthwise of wire and under braid. White or black cores.

Atlantic Insulated Wire & Cable Co., New York and Stamford, Conn.
Marking: Green and black threads crossing in braid.

Bishop Gutta Percha Co., New York, N. Y.
Marking: "Commercial" grade two green cotton threads and "Standard" grade one green cotton thread, running parallel with wire between rubber insulation and braid. White core.

Boston Insulated Wire and Cable Co., Boston, Mass., (formerly Clark Insulating Co.)
Marking: One coarse uncolored thread woven in braid. Black core.

Bourn Rubber Co., Providence, R. I.
Marking: Three green threads parallel in braid. White or black cores.

Brixey, W. R., New York.
Marking: Green and black threads parallel in braid. Black core.

Canadian General Electric Co., Toronto, Canada.
Marking: Two diametrically opposite ridges on insulation running lengthwise on the wire.

Collyer Insulated Wire Co., Pawtucket, R. I.
Marking: Two blue threads crosing in braid.

Consumers Rubber Co., Bristol, R. I.
Marking: One red and one blue thread running parallel with wire between the rubber insulation and the braid.

Crescent Insulated Wire and Cable Co., Trenton, N. J.
Marking: Red and green threads crossing in braid. Red, white or black cores.

Crescent Insulated Wire and Cable Co., Trenton, N. J., for Alfred F. Moore, Philadelphia, Pa.
Marking: Red and blue threads crossing in braid.

Detroit Insulated Wire Co., Detroit, Mich.
Marking: Two green threads running parallel in braid.

General Electric Co., Schenectady, N. Y.
Marking: Red and black threads woven parallel in braid. Red, white, or red and white cores.

Habirshaw Wire Co., Yonkers, N. Y., "Habirshaw."
Marking: Three blue threads parallel in braid. Red or white cores.

Hazard Manufacturing Co., Wilkes Barre, Pa.
Marking: Red and green threads parallel in braid. White or black cores.

Indiana Rubber and Insulated Wire Co., Jonesboro, Ind.
Marking: Two red threads parallel in braid. White or black cores.

Lowell Insulated Wire Co., Lowell, Mass.
Marking: Two blue threads running parallel with wire between rubber insulation and braid.

Marion Insulated Wire and Rubber Co., Marion, Ind.
Marking: Two green threads crossing in braid. White or black cores.

National India Rubber Co., Bristol, R. I.
Marking: Two blue threads parallel with wire between insulation and braid. Black and white cores.

New York Insulated Wire Co., New York, N. Y.
"Grimshaw," Marking: Two black threads woven into the braid, crossing each other; white core. "Raven Core," one black thread woven into braid. White or black cores.

Phillips Insulated Wire Co., Pawtucket, R. I.
Marking: Two black strands woven parallel in braid. Black core.

Roebling's John A. Sons Co., Trenton, N. J.
Marking: Red thread woven into braid. Red, white or black cores.

Safety Insulated Wire and Cable Co., New York, N. Y.
Marking: Seamless insulation and one yellow thread parallel with the wire between insulation and braid. White or black cores.

Simplex Electrical Co., Boston, Mass.
Marking: Seamless insulation. "Simplex B, C," two red cotton theads under braid and parallel to the wire. "Climax," one red thread under braid and parallel to the wire.

Standard Underground Cable Co., Pittsburg, Pa.
Marking: Green thread woven into braid. Red, white or black cores.

Waterbury Co., New York, N. Y.
Marking: Two black threads parallel with wire between rubber insulation and braid. White or black cores.

Wire & Cable Co., Montreal, Canada.

Conduit Wire—

(See list of manufacturers of rubber-covered wires.)

Slow-Burning Wire—

(Insulation consisting of three braids)—

American Electrical Works, Providence, R. I.
American Steel and Wire Co., Worcester, Mass.
Ansonia Electrical Co., Ansonia, Conn.
Benedict and Burnham Mfg. Co., Waterbury, Conn.
Collyer Insulated Wire Co., Pawtucket, R. I.
General Electric Co., Schenectady, N. Y.
Moore, Alfred F., Philadelphia, Pa.
National Conduit & Cable Co., New York, N. Y.
Phillips Insulated Wire Co., Pawtucket, R. I.
Roebling's, John A. Sons Co., Trenton, N. J.
Standard Underground Cable Co., Pittsburg, Pa.

Slow Burning Weatherproof Wire—

Slow burning insulation must be outside.

Collyer Insulated Wire Co., Pawtucket, R. I.

Weatherproof Wire—

American Electrical Works, Providence, R. I.
American Insulated Wire & Cable Co., Chicago, Ill.
American Steel and Wire Co., Worcester, Mass.
Ansonia Electrical Co., Ansonia, Conn.
Benedict & Burnham Mfg. Co., Waterbury, Conn., (formerly Holmes, Booth & Haydens Co.)
Chicago Insulated Wire Co., Sycamore, Ill.
Collyer Insulated Wire Co., Pawtucket, R. I.
General Electrical Co., Schenectady, N. Y.
Hazard Manufacturing Co., Wilkes Barre, Pa.
Moore, Alfred F., Philadelphia, Pa.
Phillips Insulated Wire Co., Pawtucket, R. I.
Roebling's, John A. Sons Co., Trenton, N. J.
Simplex Electrical Co., Boston, Mass.
Standard Underground Cable Co., Pittsburg, Pa.

Wires—

Flame Proof for Switchboards.
General Electric Co., Schenectaday, N. Y.

Wires, Miscellaneous—

Bishop Gutta Percha Co., New York, N. Y., "Bishop" rubber insulated cable with flameproof braid for car wiring.

General Electric Co., Schnectady, N. Y., "G. E." cable for car wiring.

Standard Underground Cable Co., Pittsburg, Pa., "Standard" rubber insulated cable with flameproof braid.

Flexible Cord—

Not over 300 volts—
Portions of coils not carrying stamps can be distinguished by characteristic markings.

(for pendant lamps)—
For use in places where under usual conditions the cord hangs freely in air, and is not likely to be moved sufficiently to come in contact with surrounding objects.

Long cords used with pendant lamps so that they may be caried about or hung over nails or on machinery, etc., are not included in this class, even though they are usually allowed to hang freely in air.

The flexible cord commonly known as "Commercial Cord" is not acceptable.

Okonite Co., Ltd., New York, N. Y.
Marking: Ridge on rubber insulation.

American Electrical Works, Providence, R. I.
Marking: Yellow cotton thread cabled with the copper strands.

American Steel and Wire Co., Worcester, Mass.
Marking: Soft woolen thread on rubber surface lengthwise of wire and under braid.

Boston Insulated Wire and Cable Co., Boston, Mass.
Marking: Blue threads in cotton wind around copper strands.

Crescent Insulated Wire and Cable Co., Trenton, N. J., for Alfred F. Moore, Philadelphia, Pa.
Marking: Red. white and blue cotton thread cabled with copper strands.

General Electric Co., Schenectady, N. Y.
Marking: Green threads in cotton wind around copper strands.

Goodyear Rubber Insulating Co., New York, N. Y.
Marking: One red and two green threads parallel with the conductor and between the rubber insulation and the braid.

National India Rubber Co., Bristol, R. I.
Marking: Two blue cotton threads, cabled with copper strands.

Roebling's, John A. Sons Co. Trenton. N. J.
Marking: One red thread cabled with copper strands.

Safety Insulated Wire and Cable Co., New York, N. Y.
Marking: Yellow thread in cotton wind around copper strand.

Standard Underground Cable Co., Pittsburg, Pa.
Marking: Brown thread cabled with copper strand.

Waterbury Company, New York, N. Y.
Marking: Two black threads running parallel with the wire between rubber insulation and the braid.

(for pendant or portable use)—
For markings see "Flexible Cord for Pendant Lamps."

For use with portable lamps, small portable motors, or any device which is liable to be carried about. Cord for such use must meet all the requirements for "National Electric Code Standard" flexible cord, both as to construction and thickness of insulation, and, in addition, must have an extra layer of rubber around the flexible cord, with a tough braided covering over the whole. For offices and similar places where appearance is an essential feature, a silk cover may be substituted for the weatherproof braid. In ordering, specify "National Elictrical Code Standard."

American Electrical Works, Providence, R. I.

American Steel and Wire Co., Worcester, Mass.

Boston Insulated Wire & Cable Co., Boston, Mass.

Crescent Insulated Wire and Cable Co., Trenton, N. J., for Alfred F. Moore, Philadelphia, Pa.

General Electric Co., Schenectady, N. Y.

Goodyear Rubber Insulation Co., New York, N. Y.

National India Rubber Co., Bristol, R. I.

Roebling's, John A. Sons Co., Trenton, N. J.

Safety Insulated Wire and Cable Co., New York, N. Y.

Simplex Electrical Co., Boston, Mass.

Waterbury Co., New York, N. Y.

In addition to the foregoing, the following manufacturers are prepared to furnish flexible steel armored cord.

National Metal Molding Co., Pittsburg, Pa. "Flexsteel" armored flexible cord.

Sprague Electric Co., New York, N. Y., "Greenfield Steel Armored" flexible cord.

(for Electric Heaters)—
For use with all smoothing and sad irons and any other device requiring over 250 watts.

American Electrical Heater Co., Detroit, Mich.

General Electric Co., Schenectady, N. Y.

Moore, Alfred F., Philadelphia, Pa.

Roebling's, John A. Sons Co., Trenton, N. J.

Simplex Electrical Co., Boston, Mass.

FIXTURES.

Adam, Frank, Electric Co.	St. Louis, Mo.
Black & Boyd	New York, N. Y.
Bradley & Hubbard Mfg. Co.	Meriden, Conn.
Caldwell, E. F. & Co.	New York, N. Y.
Cassidy & Son Mfg. Co.	New York, N. Y.
Chicago Gas & Electric Fixture Co.	Chicago, Ill.
Dale, The Co.	New York, N. Y.
Enos, The, Co.	New York, N. Y.
Frink, I. P.	New York, N. Y.
Gibson Gas Fixture Works.	Philadelphia, Pa.
McCoy, J. B. & Sons.	New York, N. Y.
Miller, Edward & Co.	Meriden, Conn.
Mitchell Vance Co.	New York, N. Y.
Post-Glover Electric Co.	Cincinnati, Ohio.
Sterling Bronze Co.	New York, N. Y.
Vosburgh, W. C., Mfg. Co.	New York, N. Y.

APPROVED "MISCELLANEOUS" MATERIAL

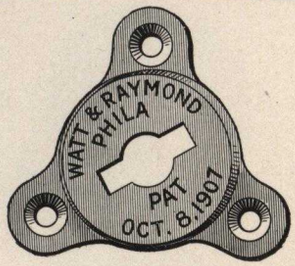


Fig. 1.

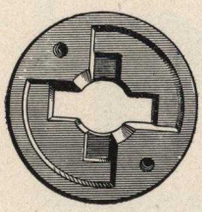


Fig. 2.

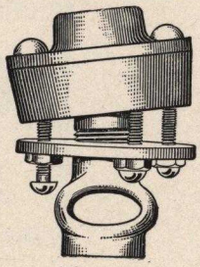


Fig. 3

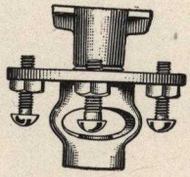


Fig. 4.

"Electrolet" Fixture Hanger. A two-piece cast iron device for chandelier and bracket fixtures, designed to hang a fixture plumb in all cases. The Crow-foot (Fig. 1) and the Adjusting Plate (Fig. 4) make a complete device for knob and tube work. Fig. 2 shows a rear view of the device with slot and recess for shoulder of hanger log. Fig. 3 shows a complete device for conduit work. Approved July 5, '08.

WATT & RAYMOND, 501 Chestnut St., Philadelphia, Pa.

MS Cord Grips. A fibre disc for use in socket and attachment plug caps, rosettes, and similar devices, replacing knot in flexible pendant cord. Approved Apr. 13, '08.

MARSHALL ELECTRIC MFG. CO., Boston, Mass.

G. E. pendant and desk type of cigar lighters, Cat. Nos. 39523 and 75234, respectively, 125 V. Approved Sept. 3, '08.

GENERAL ELECTRIC CO., Schenectady, N. Y.

Automatic Electric Shoe Polisher. A coin operated motor driven device having the switches, wiring connections, motor, brush and dust receptacle mounted on a removable wooden base. Approved Sept. 14, '08.

ELECTRIC SHOE POLISHER CO., Chicago, Ill.

Motor driven cash registers for 110 and 220 volt A. C. or D. C. circuit, (maximum current 3 A.) Motor mounted on register frame and enclosed in register case. Approved May 14, '08.

NATIONAL CASH REGISTER CO., Dayton, Ohio.

Sheet metal borders and footlight sections for stage lighting; constructed of sheet steel and provided with approved receptacles and wiring and suitable guard for borders.

Approved when installed in compliance with requirements of Rule 31-A-3, 4 ,National Electrical Code. Approved May 18, '08.

KANSAS CITY SCENIC CO., Kansas City, Mo.

Stewart Automatic High Voltage Cutout Device. An iron and slate case enclosing link fuse and automatic switch for short circuiting the service line, the latter operated by means of magnet in event of excess voltage on line. Approved Jan. 7, '07.

S. J. STEWART, New Orleans, La.

Bugproof Electric Bell. Approved for use on battery circuits. Approved Dec. 12, '04.

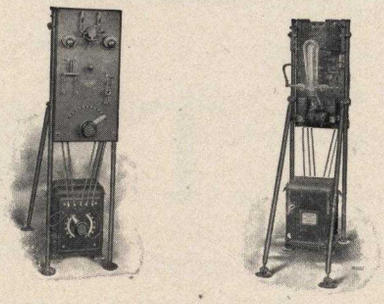
SPIES ELECTRIC CO., Chicago, Ill.

"Yost" Fiberlite Shades. Approved Dec. 22, '05.

YOST ELECTRIC MFG. CO., Toledo, Ohio.

"Hubbell" Shade Holders, Cat. Nos. 5339, 5340, 5528. "Hubbell" Shades, all styles, aluminum, tin and steel with enameled or polished reflecting surfaces. Approved Oct. 22, '07.

HARVEY HUBBELL, Inc., Bridgeport, Conn.



G. E. Mercury Arc Rectifiers for converting alternating to direct current; outfits supplied for A. C. circuits of 110-220 and 330 volts, with D. C. current capacities up to and including 50 A. Approved Apr. 13, '08.

GENERAL ELECTRIC CO., Schenectady, N. Y.

Static Electric Neutralizer. A device for neutralizing the static charge of paper fed to printing presses, consisting of a motor generator, transformer and inductor tubes. Approved Nov. 6, '06.

THE UNITED PRINTING MACHINERY CO., Chicago, Ill.

Vehicle Washer with electric light attachment, 1905 type equipped with weatherproof sockets. Approved March 28, '05.

VEHICLE SPECIALTY CO., Hartford, Conn.

Besseltric Cigar Lighter. For use on circuits of not over 125 V. A small lighting coil embedded in a porcelain disc, and provided with a suitable cutout switch and handle. Approved Jan. 3, '07.

THE BESSELTRIC LIGHTER CO., Scranton, Pa.

Auxetophone. A 1/6 H. P. motor and connections thereto for operation of phonograph. Approved Aug. 14, '06.

VICTOR TALKING MACHINE CO., Camden, N. J.

Fisher electric light attachment for typewriter. Approved Dec. 12, '04.

ELLIOTT-FISHER CO., Chicago, Ill.

Kops Mechanical Model, 110 V., O. I. A. Approved Aug. 15, '05.

KOPS BROS., New York, N. Y.

Hoe rheostat casings for printing press rheostats. Approved when properly installed. Approved Dec. 16, '04.

R .HOE & CO., NEW YORK, N. Y.

"Leucodescent" Thereapeutic Lamp for use on 110 volt circuit. Approved Aug. 10, '05.

SPEAR-MARSHALL CO., Chicago, Ill.

SECTION 2

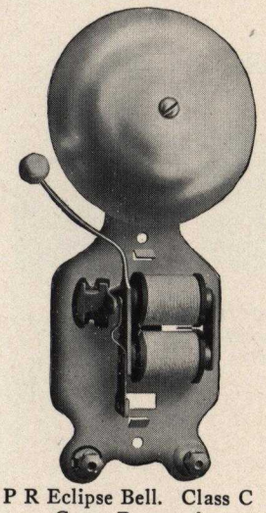
Miscellaneous Electrical Material

THE articles shown in this Section are not approved by the Underwriters' National Electric Association; few of them call for official approval.

All are shown in response to the wishes of the construction trade that a wider scope be given to ELECTROCRAFT ILLUSTRATED LIST by the addition of representative lines of other electrical supplies that the users of this book have occasion to purchase.

It has been felt by the trade ever since the first issue of this "Approved" List that the addition of a general line of electrical material would be a gain in convenience, as their files of manufacturers' catalogues are frequently very incomplete..

BELLS.

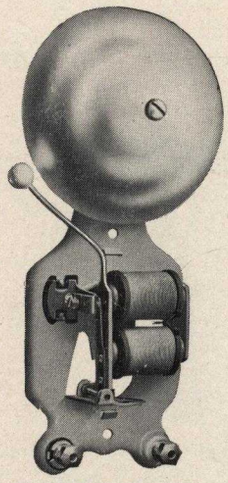


P R Eclipse Bell. Class C
Cover Removed

PR

BELLS

The product of the largest electric bell manufacturers in the world.
Noted for quality that places them in the front rank.



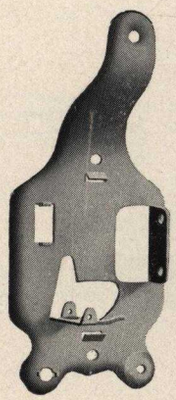
P R XXX Bell. Class C
Cover Removed.

They are unbreakable—

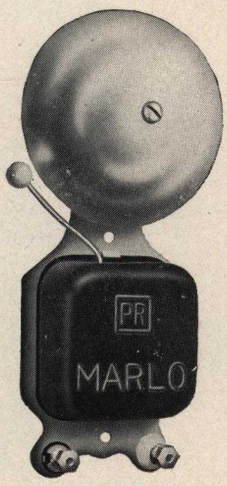
Practically the entire bell—armature, gong and magnet supports, binding posts, and cover catches--are stamped out of one piece of special soft iron.

They do not retain magnetism—

Being made of soft iron they cannot become permanently magnetized, thereby increasing their efficiency.



Stamped Soft Iron base



P R Marlo Bell. 5 ohm
Class A.

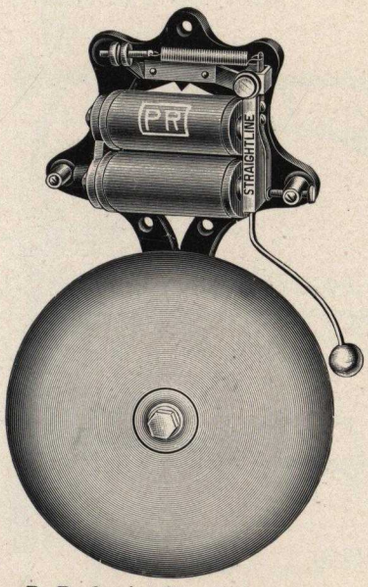
They cannot rust—

Protected by the special P R aluminizing process—a heavy electro-metallic coating.

They do not short circuit—

The fibre insulating shield makes short circuiting impossible. It also eliminates the soft rubber tubing and its troubles.

P R Iron Box Bells possess a number of other special features that distinguish them from ordinary types. The construction is such as to do away with many separate parts as well as fastening screws. The armature of soft iron is in one piece with a spring striker arm and maintains its striking position under hard service. The improved insulated binding post prevents short circuits and does not become loose.



P R Straightline Skeleton Bell

P R
Skeleton and Weatherproof Bells

Have important improvements and advantages not found on any other make.

The Base or Frame is insulated from the circuit.

No connections are made on the underside of Base to corrode or looser..

All connecting wires are concealed and incased in *Hard Rubber* tubing. No possibility for short circuits, displacements or mechanical injury to them.

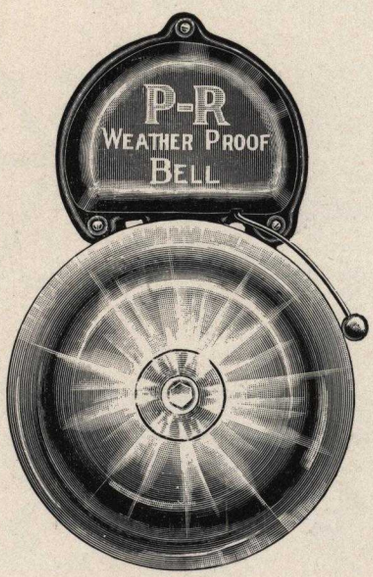
Trunion frame is made of reinforced sheet metal with enclosed end, mounting the Adjusting-Rod, Tension Spring and Armature, independent of and insulated from Base.

Wrought Bell Metal Gongs with *square* mounting hole. Cannot crack or break, uniform tone much superior to cast gongs.

Write for interesting descriptive catalogue.

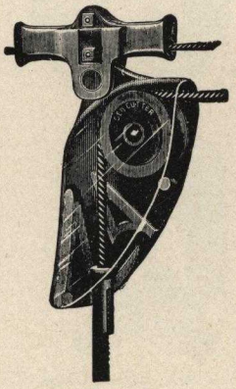
P R MANUFACTURING CO.,
Detroit, Mich.

New York Warehouse, 32 Frankfort St.

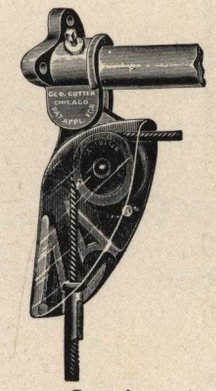


P R Weather Proof Bell.

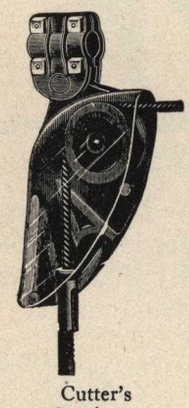
Arc Pulleys, Arc Insulators and Incandescent Street Hoods.



Cutter's Lamp-Supporting Pulley.



Cutter's Mast Arm Pulley.



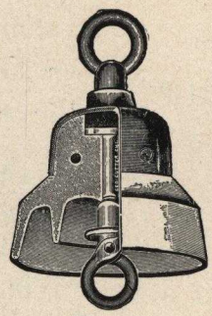
Cutter's Outrigger Pulley.

Cutter's Ceiling Pulley.

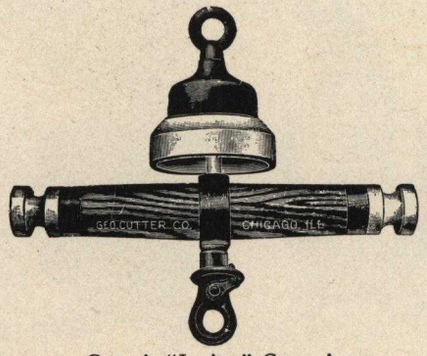
Cutter's Interchangeable Pulley.

Cutter's Swivel Pole Pulley.

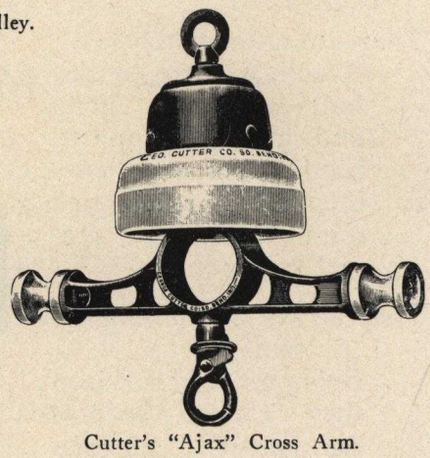
Cutter's High Voltage Insulator.



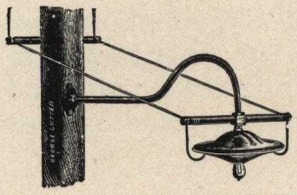
Cutter's "Jupiter" Insulator.



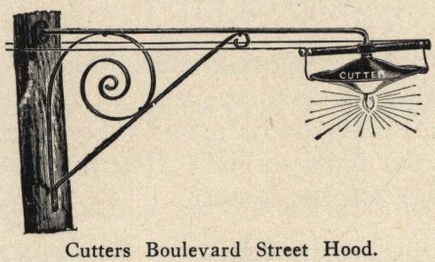
Cutter's "Jupiter" Cross Arm.



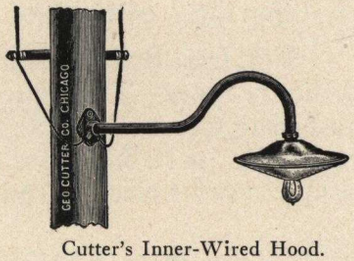
Cutter's "Ajax" Cross Arm.



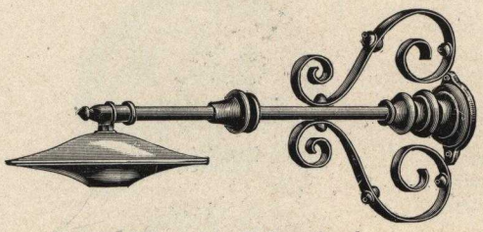
Cutters Standard Street Hood.



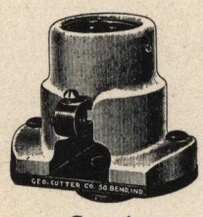
Cutters Boulevard Street Hood.



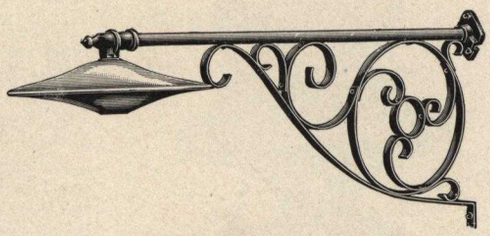
Cutter's Inner-Wired Hood.



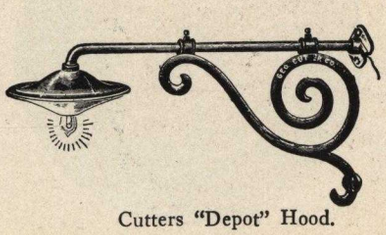
Cutter's "Corinthian" Streethood.



Cutter's Streethood Socket.



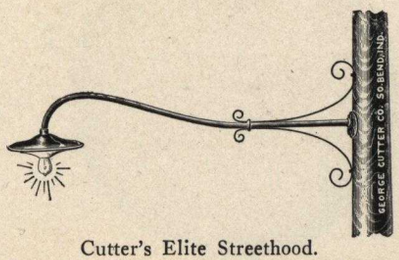
Cutter's "Delphian" Streethood.



Cutters "Depot" Hood.

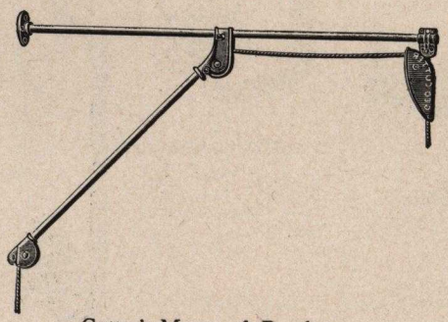
GEO. CUTTER COMPANY,
South Bend, Ind.

(Continued on next page).

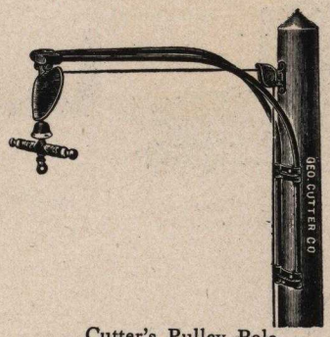


Cutter's Elite Streethood.

Arc Brackets and Mast Arms.

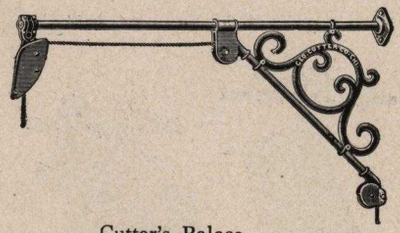


Cutter's Mammoth Bracket.

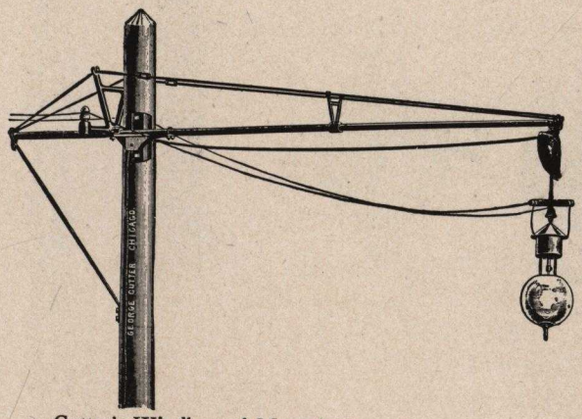


Cutter's Pulley Pole Fixture.

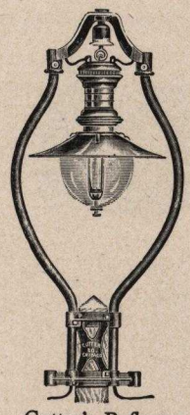
Cutter's Cast Scroll Bracket.



Cutter's Palace Outrigger.

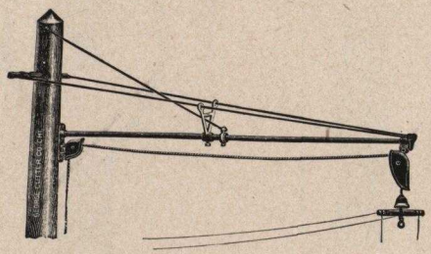


Cutter's Windbraced Mast Arm.

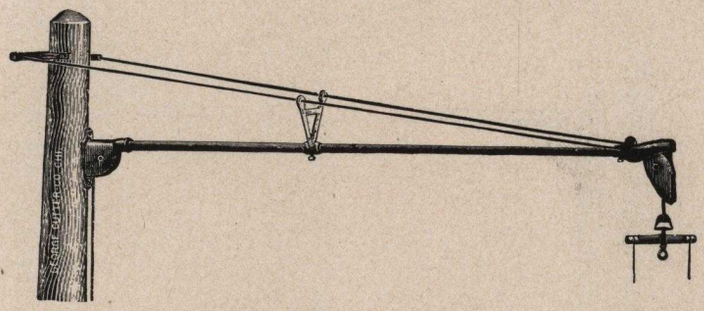


Cutter's Reflector Poletop.

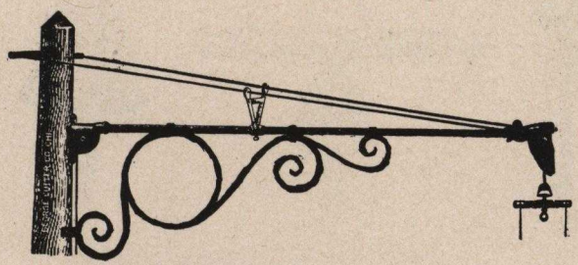
Cutter's Scroll Pulleyed Outrigger.



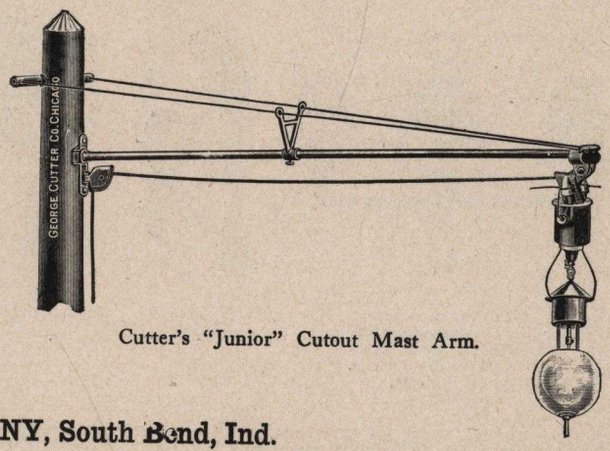
Cutter's "Long Junior" Mast Arm.



Cutter's Inner-Rope Mast Arm.



Cutter's Ornamental Inner-Rope Mast Arm.

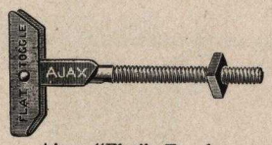


Cutter's "Junior" Cutout Mast Arm.

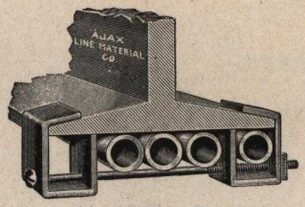
GEO. CUTTER COMPANY, South Bend, Ind.

ELECTRIC LIGHT SPECIALTIES.—(Continued.)

"Ajax" Toggle Bolts, Conduit Clamps and Insulator Brackets.

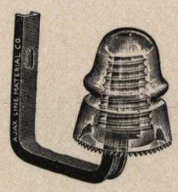


Ajax "Flat" Toggle Regular "Ajax Toggle Bolt" Made in eight sizes. For prices, see Winter Bulletin.



Ajax Girder Clamp (Also other types).

Cast Pin Break-Arm (Also other types)



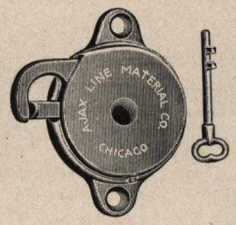
Channel Steel Insulator Brackets with "all steel" tips.

"Ajax" Pulleys and Arc Suspension Devices.

Clamp pulley Ajax Safety Pulley (Made in five types.)

Ajax Swivel Pulley For prices see Winter Bulletin.

Rope Clamp

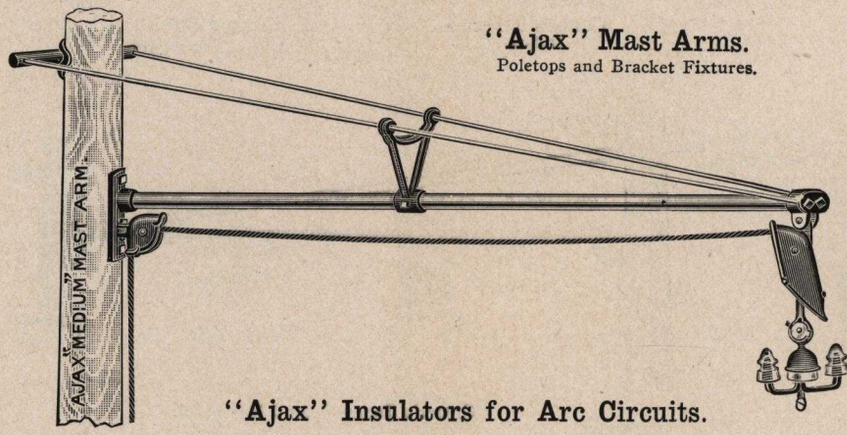


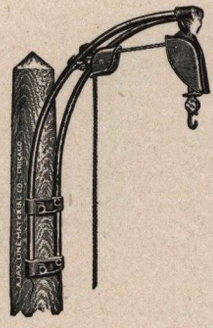
Ajax Pole Lock

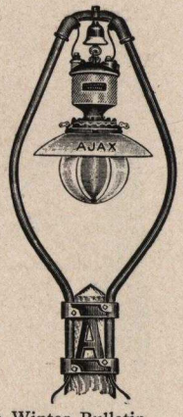
Rainproof Rope and Galvanized Chain.

"Ajax" Mast Arms.

Poletops and Bracket Fixtures.

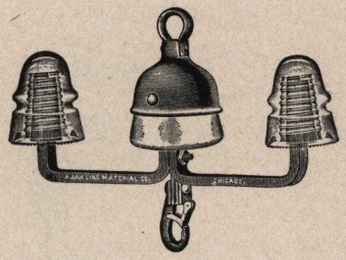




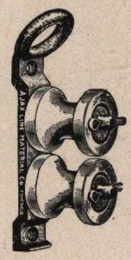


For 18 other types, see Winter Bulletin.

"Ajax" Insulators for Arc Circuits.



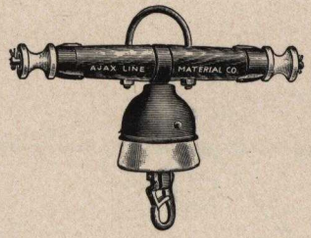
Ajax Volta Arm for high voltage circuits. For more of these extra durable insulating devices, see Winter Bulletin.



Ajax Tree Insulator

Insulated Hook

Insulated Bolts and Turnbuckles.



Ajax "Competition" Arm.

(And six other types of Insulating Arms).

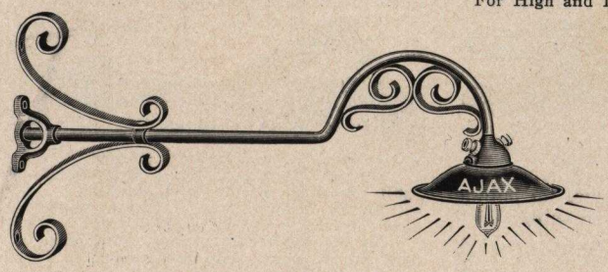
Insulator Ajax Chain

AJAX LINE MATERIAL CO., 12-14 S. Jefferson St., Chicago, Ill.

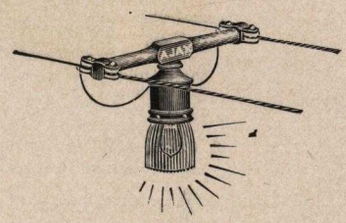
(Continued on next Page)

"Ajax" Tungsten Street Fixtures.

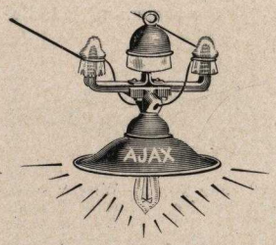
For High and Low Voltage Circuits.



Ornamental Tungsten Street Fixture



"Holotung" Taut Hood (with Holophane No. 243 Street Lighting Reflector.



Ajax Tungsten Tee Hood for series circuits.

Send for special Ajax-Tungsten Bulletin.

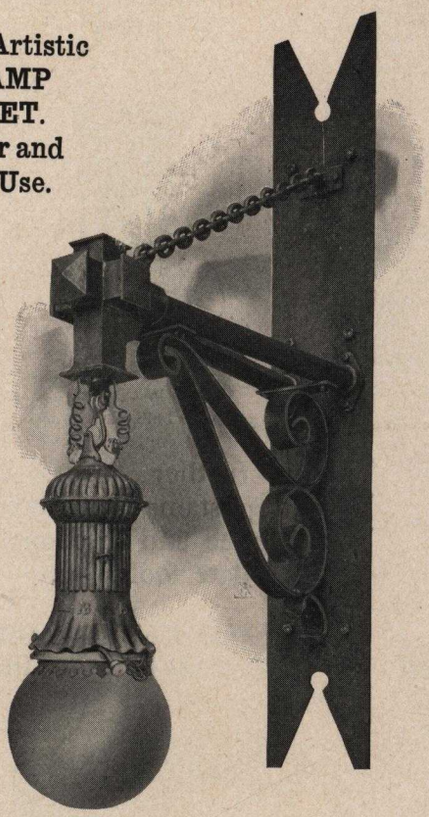
AJAX LINE MATERIAL CO., 12-14 S. Jefferson St., Chicago, Ill.

New and Artistic ARC LAMP BRACKET. For Indoor and Outdoor Use.

Massive in construction.

Ornamental in design.

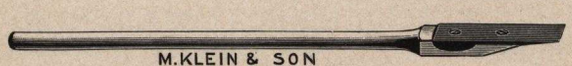
Possesses features of novel character.

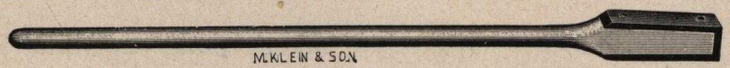


Write for description and prices.

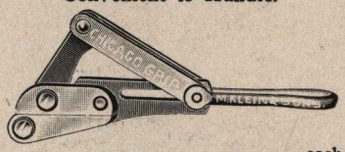
AMERICAN ELECTRIC CONSTRUCTION CO., 315 Chamber of Commerce Bldg., Chicago, Ill.,

Klein's Lineman's and Construction Tools.

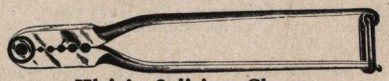




Klein's "New Chicago Grip" It Grips and Holds and is Most Convenient to Handle.



		each
0358	For No. 10 Wire & smaller.	$3.80
358A	For No. 6 Wire & smaller.	4.00
358C	For No. 0 Wire & smaller.	6.60
358E	For No. 0000 Wire & smaller.	10.00



Klein's Splicing Clamps

308	Baby, 7-inch for 10, 12, 14, 16, Copper Wire	$2.70
302	Standard size for 8, 10, 12, 14, Iron Wire ..... each	3.20
302A	For 6, 8, 10, 12, 14, Iron Wire each	3.40

"Klein's Special" Side Cutting Pliers

312	5 inch plain	Each	$2.00
312A	6 inch plain	Each	2.50
312B	7 inch plain	Each	3.00
312C	8 inch plain	Each	3.60
312D	9 inch plain	Each	3.60
312E	10 inch plain	Each	5.00

Also other styles.

Klein's New "Chicago Lineman's Tool" Latest Adaptation to Needs of Line Construction Men.

3358	For No. 10 Wire and Smaller Single Purchase	Each	$10.00
3358A	For No. 6 Wire and Smaller Single Purchase	Each	10.20
3358C	For No. 0 Wire and Smaller Single Purchase	Each	12.80
3358R	For No. 10 Wire and Smaller Double Purchase	Each	11.80
3358S	For No. 6 Wire and Smaller Double Purchase	Each	12.00
3358T	For No. 0 Wire and Smaller Double Purchase	Each	14.60

Klein's Tree Trimmers

394	Favorite tree trimmer..Each	$3.60
395	Favorite tree trimmer..Each	4.40

Klein's New "Chicago Grip" For insulated wire. Will not slip or injure the Insulation.

358 I	For No. 4 Wire and smaller Each	$6.50
358K	For No. oo Wire and smaller Each	8.00

Telegraph Post Hole Spoons.

7 ft., 8 ft., 9 ft.

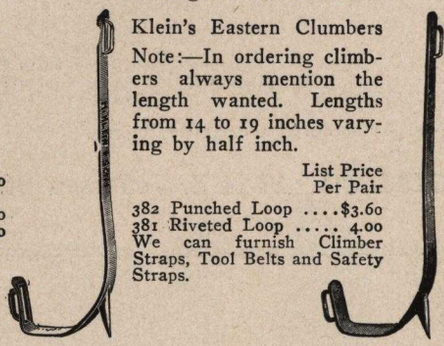
Klein's "Quick Samson" Strand Grip.

363S	Holds from 5/16 to 5/8 strand each	$24.00
363B	For trolleywire, same as above, each	23.00

A quick, safe, secure device for pulling messenger or strand wire.

Klein's Eastern Clumbers

Note:—In ordering climbers always mention the length wanted. Lengths from 14 to 19 inches varying by half inch.



	List Price Per Pair
382 Punched Loop	$3.60
381 Riveted Loop	4.00

We can furnish Climber Straps, Tool Belts and Safety Straps.

Gasoline Furnace.

550, with bulb, each $7.00

For further information send 3c stamps for 65 page catalogue and discounts of up-to-date tools.

MATHIAS KLEIN & SONS, Sta. U. 4. Chicago, Ill.

Klein's Haven's Steel Clamp.

This is a very efficient clamp for all around work.

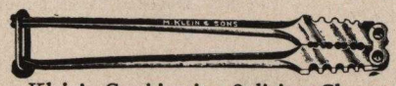
368	For No. 8 Wire and finer Each	$3.00
369	For No. ½ Wire and finer Each	5.50

Chicago Brand.

Write for Discounts.

Klein's "New Chicago Grip" with Pulleys.

358	For No. 10 Wire and smaller for ¼ in. rope..... each	$4.80
358B	For No. 6 Wire and smaller for ⅜ in. rope..... each	5.00
358D	For No. 0 Wire and smaller for ½ in. rope..... each	7.60
358F	For No. 0000 Wire and smaller for ⅝ in. rope..... each	11.50



Klein's Combination Splicing Clamps.

No. 309.	For No. 6, 8, 10, 12, 14 Iron Wire and 8, 10, 12, 14 B. & S. Sleeves ..... Each	$3.60
No. .0309.	For No. 6, 8, 10, 12, 14 Iron Wire and 8, B. W. G. and 8, 10, 12, B. & S. McIntire Sleeves	3.60

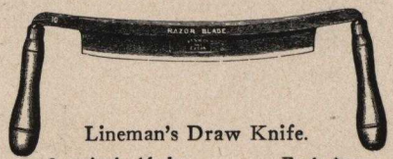
Also other styles.

Lineman's Hand Axe.

530A,	4-inch ..... Each	$1.50
530B,	5-inch ..... Each	1.80
530C,	6 inch ..... Each	2.25

Klein's New "Chicago Lineman's Tool" For Insulated Wire.

3358 I	For No. 4 Wire and smaller Single Purchase	Each	$12.60
3358K	For No. oo Wire and Smaller Single Purchase	Each	14.10
3358U	For No. 4 Wire and Smaller Double Purchase	Each	14.50
3358V	For No. oo Wire and Smaller Double Purchase	Each	16.00



Lineman's Draw Knife.

548	12-inch blade ..... Each	$2.00
549	14-inch blade ..... Each	2.20

Klein's New "Chicago Grip" with Pulleys. For insulated wire.

358 I	For No. 4 Wire and smaller for ½ in. rope..... Each	$7.50
358L	For No. oo Wire and smaller for ½ in. rope..... Each	9.00

Telegraph Post Hole Shovels.

7 ft., 8 ft., 9 ft.

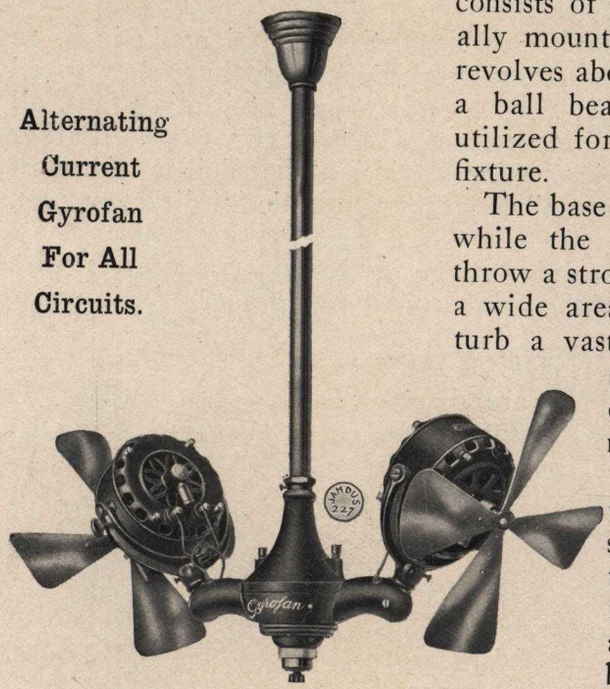
FANS.

THE JANDUS GYROFAN consists of two fan motors pivotally mounted on a frame which revolves about the vertical axis on a ball bearing. No current is utilized for the revolution of the fixture.

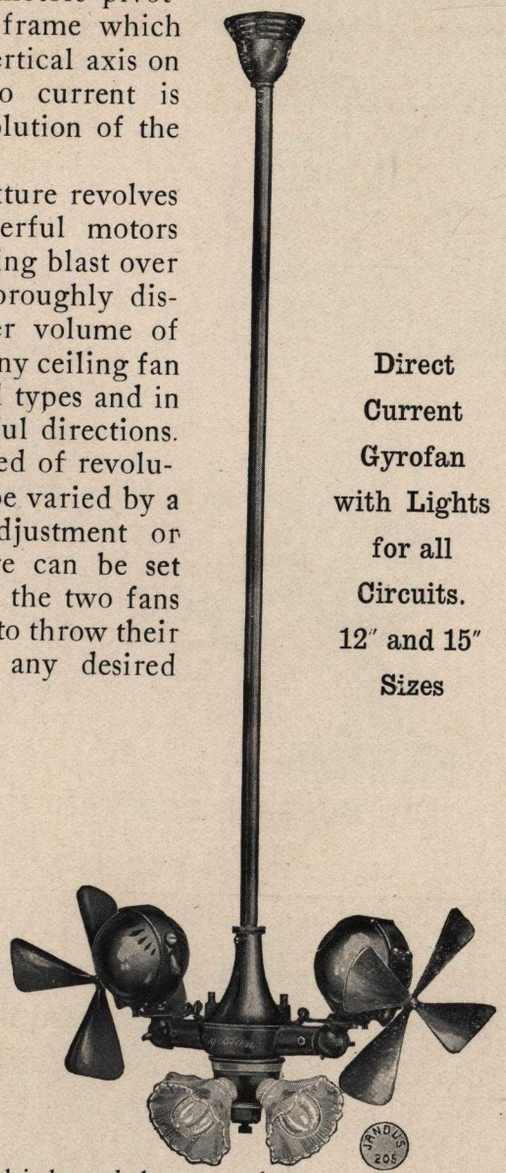
The base of the fixture revolves while the two powerful motors throw a strong whirling blast over a wide area and thoroughly disturb a vastly greater volume of air than any ceiling fan of the old types and in more useful directions.

The speed of revolution can be varied by a simple adjustment or the fixture can be set rigid and the two fans arranged to throw their blasts in any desired direction.

Alternating Current Gyrofan For All Circuits.



Direct Current Gyrofan with Lights for all Circuits. 12″ and 15″ Sizes



Built for all circuits, both A. C. and D. C. in 12 inch and 15 inch sizes, for both column and ceiling service, with or without lights.

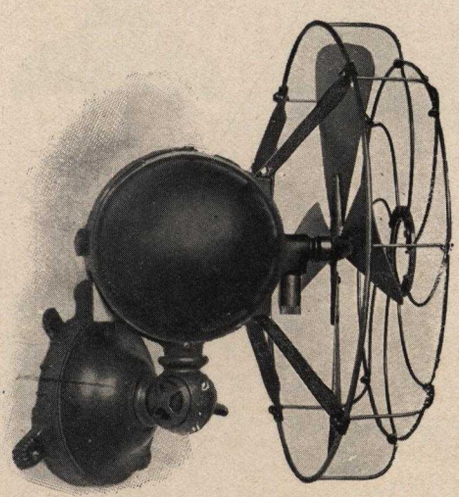
The JANDUS DESK AND BRACKET FAN has established its reputation for mechanical excellence, strength and durability, neat and tasteful appearance, adaptability of service and high electrical efficiency.

It is supplied in all desirable sizes and voltages for both D. C. and A. C. circuits.

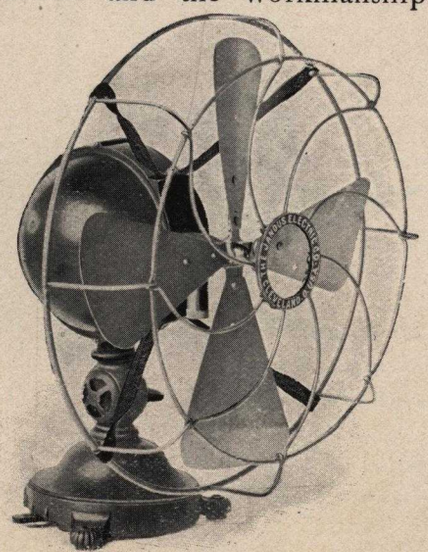
The armature and field cores of the D. C. fans are of soft laminated iron and the fields are flexibly supported so as to withstand shock or jars.

The speed is slow, but the velocity of air blast is high and the rate of current consumption very economical. The bearings are self-aligning.

The brush holder and other parts are simple in construction and the workmanship throughout is of high order.



The Jandus fans have been adopted as standard for railway service on the American continent and are used generally by the principal car builders and sleeping car companies.

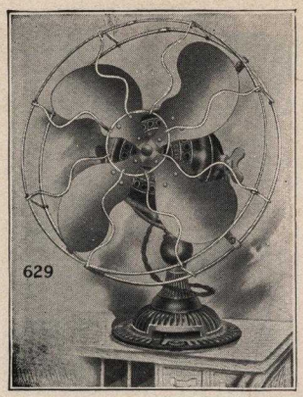


THE JANDUS ELECTRIC CO.,

114 Liberty Street, New York.
23 East Lake Street, Chicago.
1211 Filbert Street, Philadelphia.

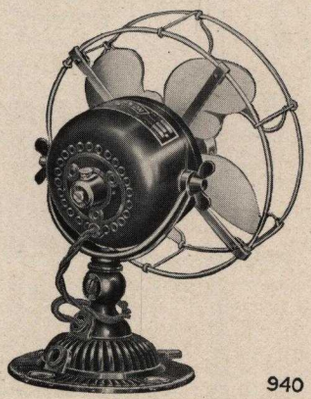
FANS.—(Continued.)

"Emerson" Fans.


629

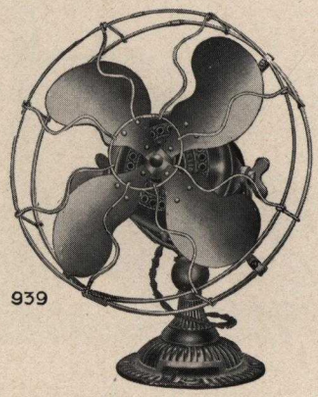
"EMERSON" INDUCTION DESK FANS made in 8, 12 and 16 inch sizes for general use and 12 inch slow speed "Residence" type, also 12 and 16 inch oscillating fans, all convertible into bracket fans without extra parts. Parker blades, automatic starting device, high efficiency form of winding. "Emerson" desk fans also made for direct current.

"TROJAN" DESK FANS are induction type motors with many features of the "Emerson" but slightly lower in price.


940

"EMERSON" INDUCTION CEILING FANS are direct-connected 3-speed motors, 2 and 4 blade styles, complete with hangers, decorative design and oxidized copper finish.

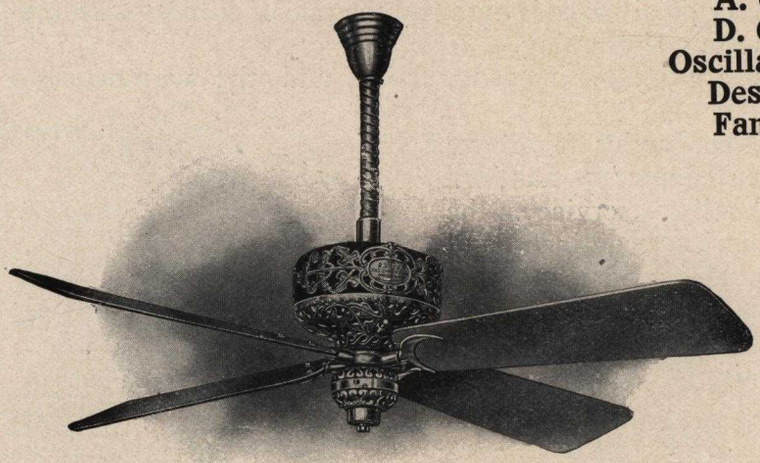
"TROJAN" CEILING FANS are plainer types similar to the "Emerson," but are 2-speed fans without hanger pipes. Single speed column fans also furnished. Catalogue sent on request.


939

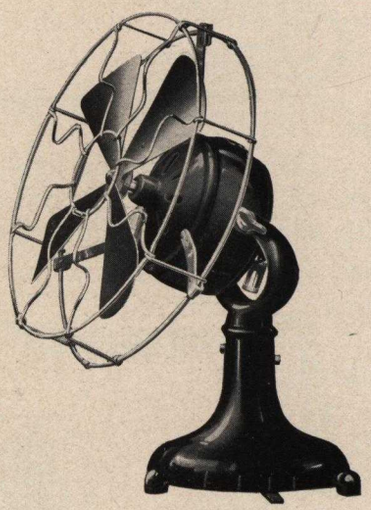
THE EMERSON ELECTRIC MFG. CO., Factory and Main Office, St. Louis, Mo.

Eastern Office and Warehouse,
Hudson Terminal, 50 Church St., New York City.

Alternating and Direct Current Fans
Plain and Ornamental Ceiling Fans
Electrolier and Column Types
All Voltages



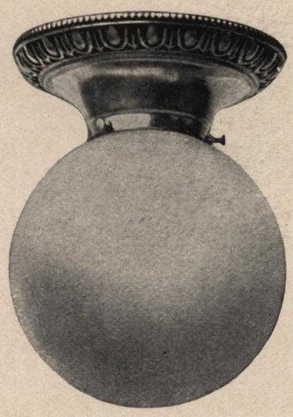
A. C.
D. C.
Oscillating
Desk
Fans



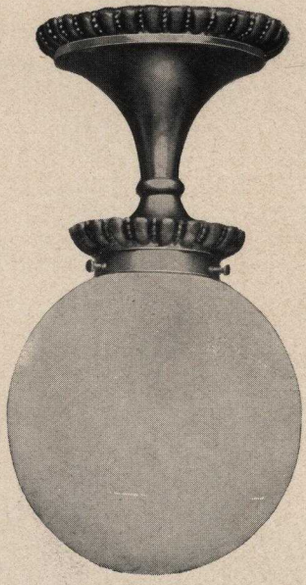
8 inch
12 inch
16 inch
Every Voltage

THE DAYTON FAN & MOTOR CO.,
31 Bayard Street, Dayton, Ohio.

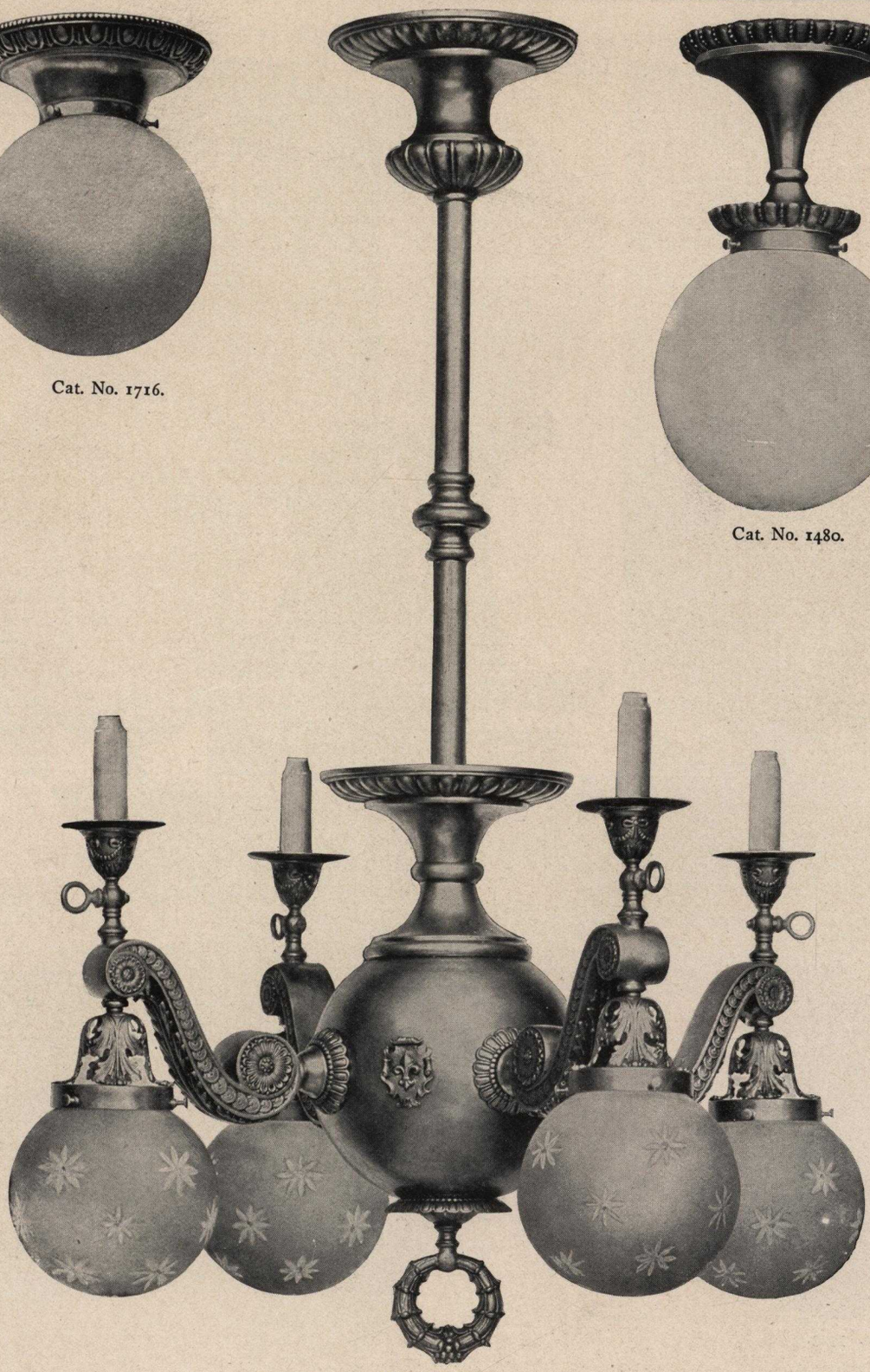
FIXTURES.



Cat. No. 1716.



Cat. No. 1480.



Cat. No. 5266.

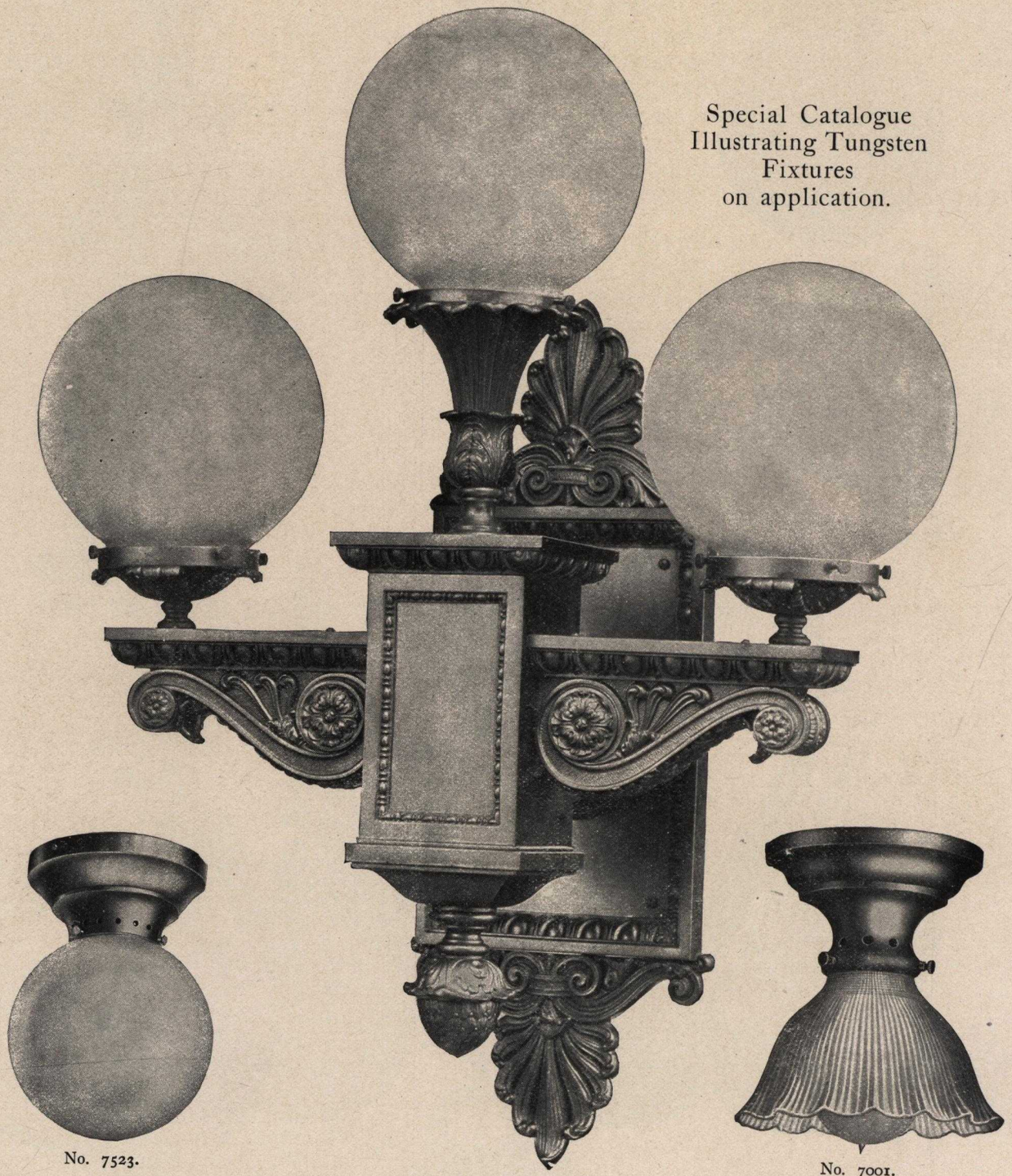
Manufacturers of a complete line of LIGHTING FIXTURES for Residences, Churches and all Public Buildings, including GAS, ELECTRIC and COMBINATION FIXTURES, ART GLASS DOMES and SHADES, coppered or leaded; ELECTRIC SOCKETS, TRIMMINGS for Gas and Electric Fixtures.

Catalogs showing a complete line of ELECTROLIER, COMBINATION and GAS FIXTURES, are sent to *dealers* for the asking. Sold to the TRADE only.

BEARDSLEE CHANDELIER MFG. CO., 176-180 So. Clinton St., Chicago, Ill.

Electric Lighting Effects for All Requirements

Special Catalogue
Illustrating Tungsten
Fixtures
on application.



No. 7523.

No. D 2160.

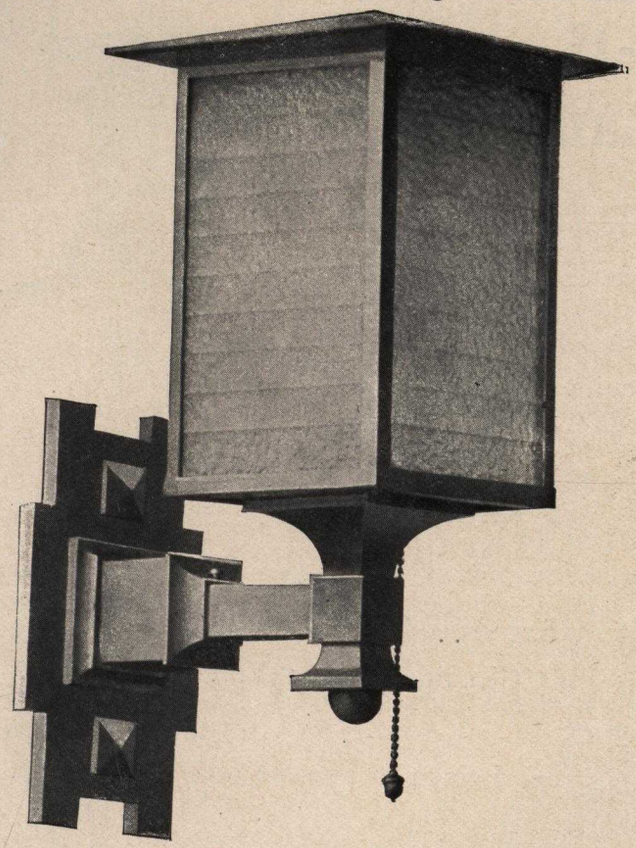
No. 7001.

R. Williamson & Co. manufacture everything in both Electric and Gas Lighting goods and furnish—to the trade only—Illustrated catalogues, showing a complete line of all approved Electrical Supplies for Lighting fixtures, making it possible to place a complete order, which you will find is quite an advantage.

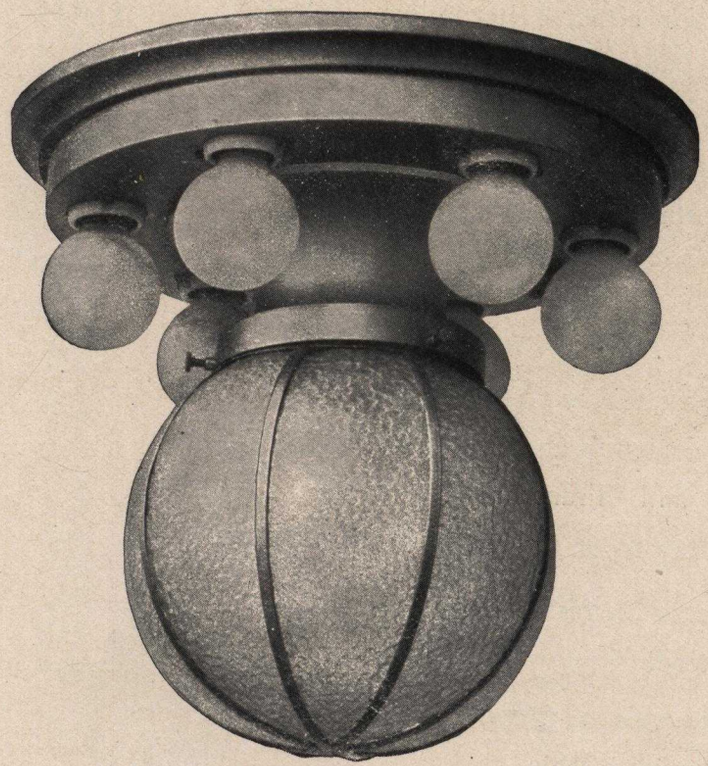
R. WILLIAMSON & CO., Washington & Jefferson Sts., Chicago, Ill.

(Continued on apposite page)

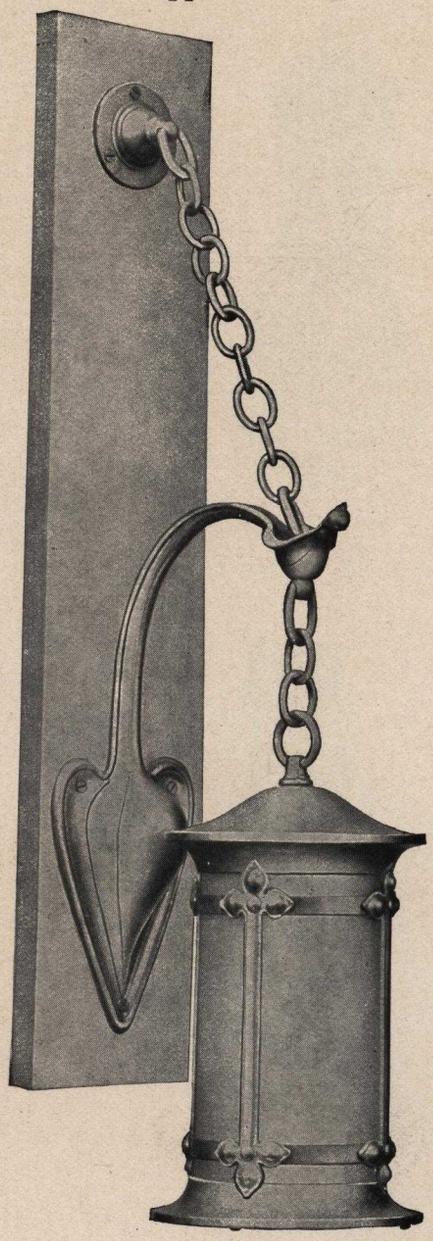
Electric Lighting Fixtures and Approved Lighting Supplies.



D. 2347.



D. 3140.



D. 2343.

To the Trade:

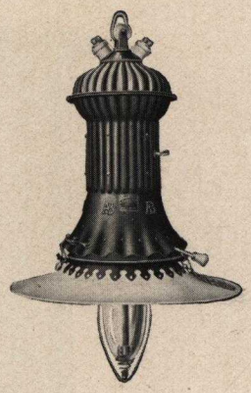
R. Williamson & Co. will furnish their complete catalogue to all who are entitled to Trade consideration. In making a request for catalogue, please mention "Electrocraft," as it will entitle you to this catalogue.

This Company manufactures everything in the Chandelier line, and in connection with which they carry in stock a complete line of approved Lighting supplies.

R. WILLIAMSON & CO., Washington & Jefferson Sts., Chicago, Ill.

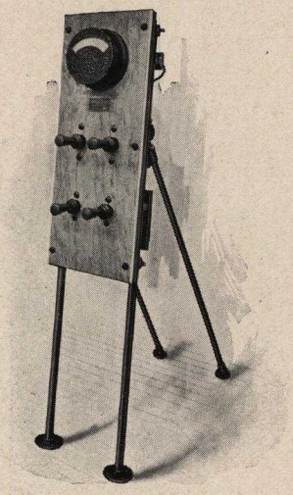
Manufacturers of Gas and Electric Fixtures and Fittings
and dealers in Miscellaneous Lighting Supplies.

A-B
Arc Lamps



Multiple Direct Current Lamps for 110 and 220 Volt Circuits.

Multiple Alternating Current Lamps for 110 and 220 Volt Circuits.

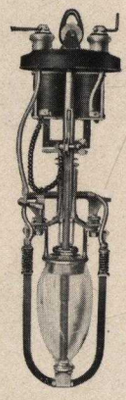


Multiple Alternating Auto-Coil Lamps to operate on 220 Volt Circuit, with 75 Volt Arc.

Alternating Current Lamps to operate on 25 cycles, 110 Volts.

Lamps for Blue Print and Photo-Engraving work for either Alternating or Direct Current.

Complete switch boards, for Direct and Alternating Current operations, built to conform with standard specifications.

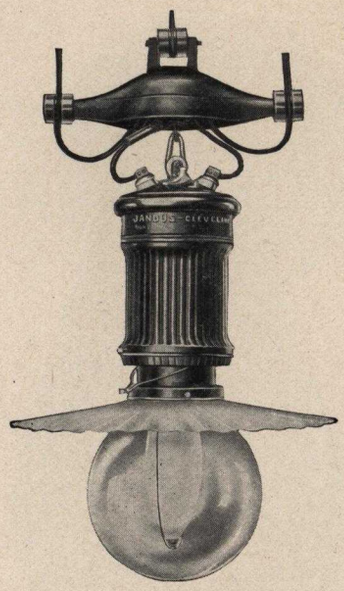


Series Alternating lamps and Constant Current Regulators and Transformers, interchangeable for either 60 or 133 cycles.

Complete systems furnished and highest efficiency guaranteed.

THE ADAMS-BAGNALL ELECTRIC CO.,
Cleveland, Ohio.

143 Liberty St,. New York, N. Y. **303 Dearborn St., Chicago, Ill.**



Jandus Enclosed Arc Lamps (For all Circuits).

Jandus Series A. C. Arc Lighting Apparatus.

POINTS OF EXCELLENCE.

LONG LIFE attained by use of the patented diffusion chamber.

200 hours per trim for Multiple D. C. lamps

150 Hours per trim for Multiple A. C. lamps.

150 hours per trim for Series A. C. lamps.

Saves half the cost of carbons and trimming.

All working parts are of copper, brass or bronze and all screws and cotter pins are of brass and bronze.

Mechanism cannot be damaged by rust or acid fumes.

The lamp is very attractive in appearance.

The mechanism is simple in construction and the parts strong and durable.

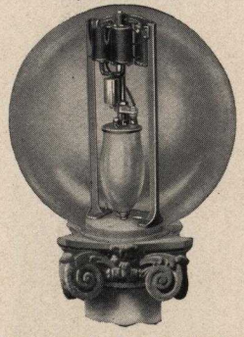
All parts easily accessible for inspection or repair and any part can be removed in a moment without disturbing the lamp structure.

The adjustments for current and voltage are easy to handle.

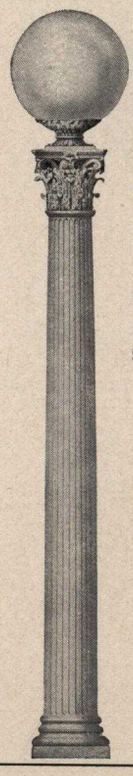
Daniels Boulevard Lighting System.

(Patented.)

Artistic Lighting Fixtures.



For Street and Park Illumination



Upon re-enforced concrete columns of classic design are mounted Jandus Arc Lamp mechanisms enclosed within 20-inch opal glass ball globes.

The Lamp is of the regular enclosed type with the Jandus patented diffusion chamber, takes a four-inch lower and nine-inch upper carbon and will attain an average life of 125 hours per trim.

The system has been designed to operate on Multiple Direct-Current, Multiple Alternating-Current and Series Alternating-Current Circuits.

The Large Globe gives perfect diffusion of light, eliminates the glare and travel of the arc and produces a quality of illumination heretofore unequalled.

The Concrete Post is eleven feet in height and is moulded and finished to correspond to sand-stone, marble, granite or any natural stone. It is more attractive in appearance, more durable and less expensive than the iron posts now usually employed for arc lamp support.

Pressed Steel Posts can be supplied at one-half the cost of cast iron posts.

Pressed Copper Posts cost no more than cast iron posts.

COMPARATIVE ADVANTAGES:

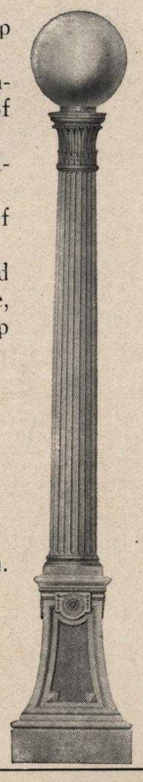
Economy in cost per unit.

Beauty of design in harmony with surroundings.

The short post brings the lamp nearer the ground where the light is most needed.

The large globe gives better diffusion, resulting in less brilliancy but better illumination.

Detailed information and costs gladly furnished.



THE JANDUS ELECTRIC COMPANY, Cleveland, O.

New York Office
114 Liberty Street.

Philadelphia Office
1211 Filbert Street.

23 East Lake Street
Chicago Office

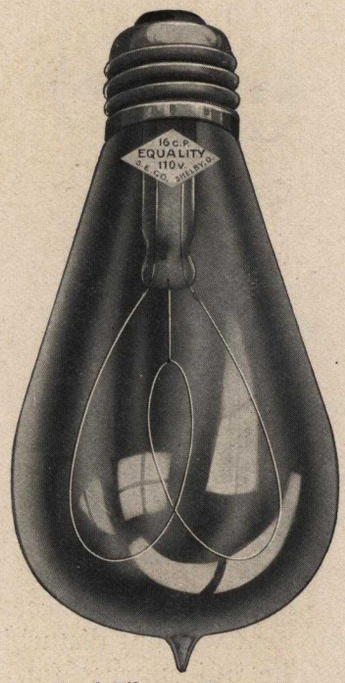
Shelby Lamps

Shelby Useful Light Lamp.

Shelby Useful Light Lamps for a given current consumption and life produce more light in a downward direction than other carbon filament lamps.

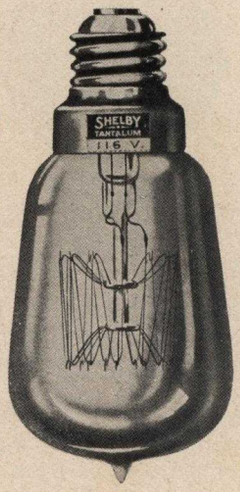
"EQUALITY"

A high grade oval filament lamp. It gives much more light horizontally than it does in a downward direction.

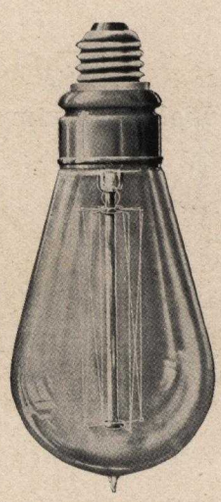


Oval Filament Lamp.

Shelby Gem.



Shelby Tantalum.



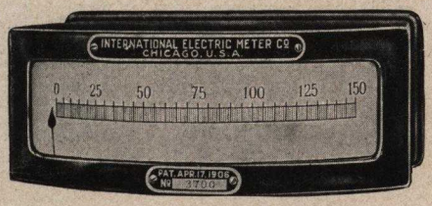
Shelby Tungsten.

These lamps should generally be used with reflectors. Such a procedure materially reduces the amount of light in a horizontal direction but increases the amount of useful, i. e. downward light.

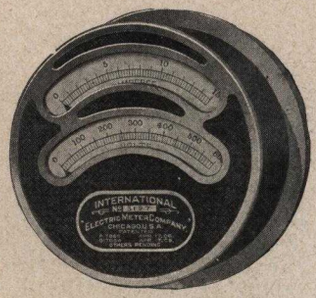
SHELBY ELECTRIC COMPANY, Shelby, Ohio.

INSTRUMENTS.

Nos. 6 and 13.



Nos. 8 and 15.



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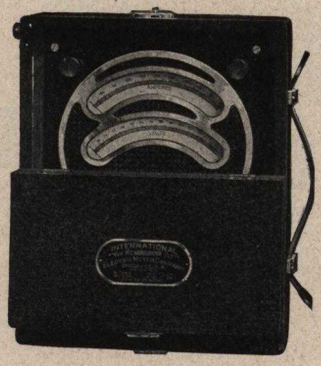

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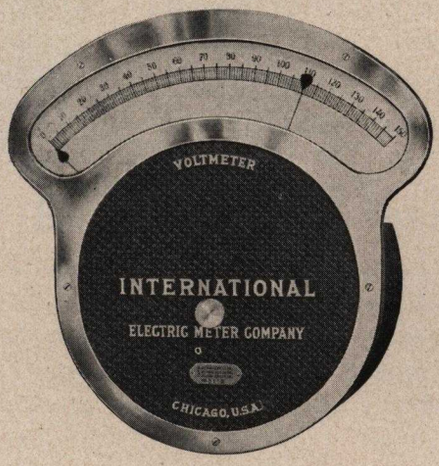
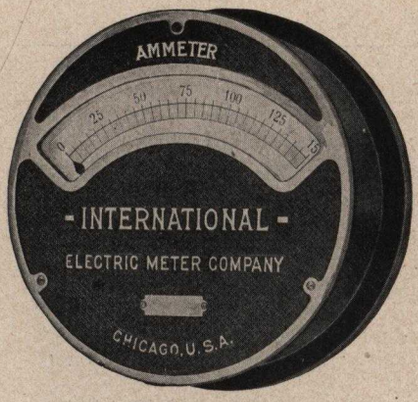


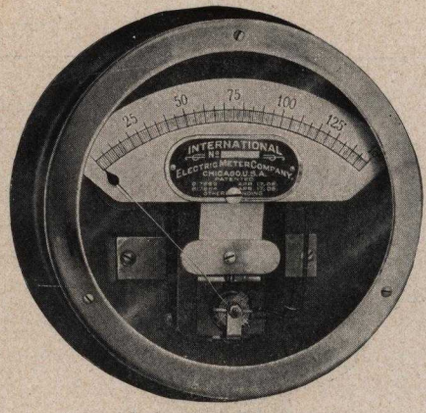
Nos. 7 and 14.

Nos. 17, 22 and 23.



Nos. 5 and 12.

Hoskins Pyrometer.



School Laboratory Instrument.

The Manufacturers' descriptive Catalogue will interest you. Send for it.

INTERNATIONAL ELETRIC METER CO., Chicago, U. S. A.

Postal Tel. Bldg. New York.	Ideal Bldg. Denver.	9 So. 10th St. St. Louis.	San Jose Bank Bldg. San Jose, Cal.

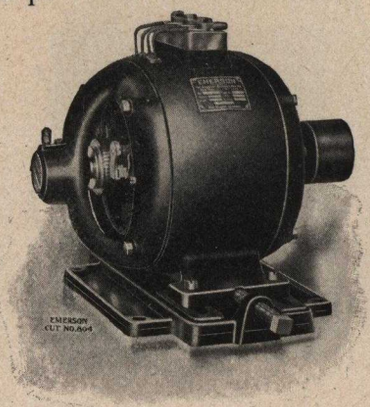
MOTORS.

"Emerson" Motors.

"EMERSON" SINGLE PHASE INDUCTION MOTORS are made in a variety of frames 1/40 to ½ h. p. All start promptly, many types starting under load. Ground steel shafts, bronze bearings, self-oiling. Same form of field winding used on large induction motors, resulting in low current consumption. Every motor tested under brake load and overload. Guaranteed for one year from date of shipment from factory.

"EMERSON" MULTIPHASE INDUCTION MOTORS made in sizes ¼ to 1 h. p.

"EMERSON" DIRECT CURRENT MOTORS, bipolar enclosed and ventilated types 1/20 to ½ h. p., multipolar enclosed motors ¼ to 2 h. p. Thoroughly high grade construction in every respect. Ratings are actual brake loads, established under careful test. Large variety of frames.

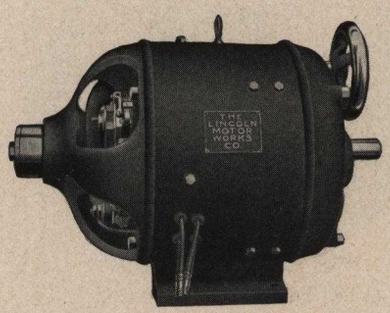


"EMERSON" alternating and direct current motors are also furnished direct connected to blowers and exhaust fans, and with special equipments for use as lathes, for driving sewing machines, family washing machines, etc. Bulletins sent on request.

THE EMERSON ELECTRIC MFG. CO., Factory and Main Office, St. Louis, Mo.

Eastern Office and Warehouse,
Hudson Terminal, 50 Church St., New York City.

Lincoln Variable Speed Motor.



This motor is specially designed for the individual drive of machine tools and other machinery requiring variable speeds. The advantages and characteristics of this motor are briefly as follows:

1. No electrical controller is required.
2. The speed variation is obtained by the simple mechanical device of shifting the armature.
3. The motor is therefore wired up and installed on a regular two-wire circuit in exactly the same manner as any direct current shunt wound constant speed motor.
4. The motor is reversible and will run with like results in either direction, without shifting the brushes.
5. Ranges in speed even as high as one-to-ten are not only possible but practicable.
6. An infinite number of speeds can be obtained at will between the minimum and maximum speed limits of the motor, the speed change being smooth, continuous and gradual.
7. The motor will develop its full rated capacity at all speeds, that is, with constant input, the torque varies practically inversely as the speed, giving constant output. There is no decrease in capacity as the speed decreases.
8. When set for any given speed the motor maintains a constant speed under varying load. In fact, the drop in speed from no load to full load at any speed is exceedingly small, comparing favorably with the best constant speed motor practice.
9. By the use of special commutating poles, sparkless commutation is obtained even up to 50% overload when running at any speed in either direction.
10. By the use of steel frames and economical design, a very light and compact motor is obtained for a given horsepower rating and efficiency. This is very important where the motor is to be mounted directly on the machine it is to drive.
11. All these facts make still more remarkable the high electrical and mechanical efficiency as shown by tests made by the United States Government and other disinterested and practical users.

The manufacturer is also prepared to furnish a complete line of constant speed motors of standard design for either direct or alternating current service.

Full information and prices furnished on request.

THE LINCOLN MOTOR WORKS COMPANY,

Huron Road. **Cleveland, Ohio.**

"Fort Wayne" Transformers.

TYPE A TRANSFORMERS have for years given such excellent service under all conditions of operation that their design and construction is accepted as reliable and economical in operation.

Low operating temperature, high insulation strength, vacuum treated coils, and silicon steel laminated cores, used for several years past, all combine to make the Type A transformer, one upon which the utmost reliance can be placed.

Rigid factory tests insure uniform quality. Ask for Bulletin J1096—it gives complete description.

FORT WAYNE ELECTRIC WORKS,
"Wood" Systems.
Fort Wayne, Indiana.

750

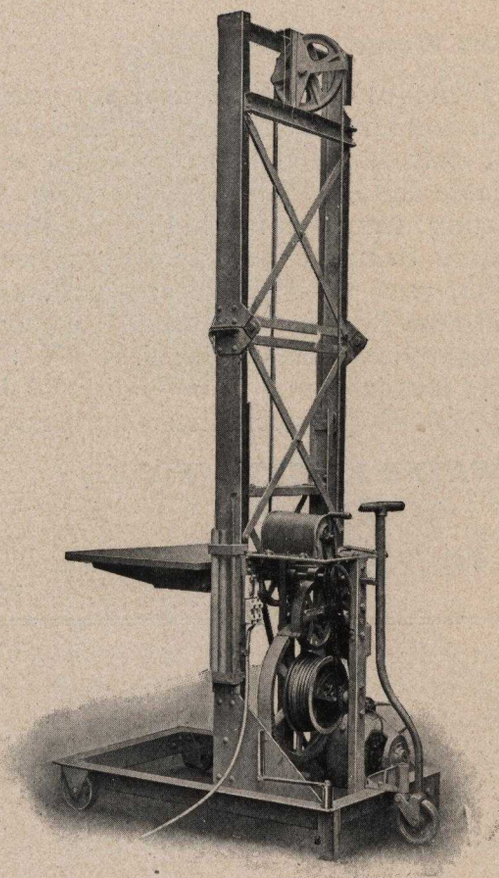
"Fort Wayne" Induction Wattmeters

TYPE K INTEGRATING INDUCTION WATTMETERS embody to the greatest extent the many qualities of a perfect meter, and this fact is evidenced by their general use by many of the larger as well as smaller Central Stations. All of the varying conditions met with in wattmeter service have had consideration in the design of the Type K wattmeter. Every possible condition has been recognized and successfully met in this meter. They are made for single-phase and multiphase circuits of all standard voltages.

Complete descriptions of these meters given in Bulletins J1053 and J1074—sent free on request.

FORT WAYNE ELECTRIC WORKS,
"Wood" Systems.
Fort Wayne, Indiana.

749



Standard Direct Current Machine.

PORTABLE ELEVATORS.

(Economy Electric Tiering Machines.

The Economy Electric Tiering Machine fills the demand for a power portable elevator suitable for warehouse use in piling and storing heavy merchandise of all kinds. It is strictly portable and is easily taken to any part of the floor and run up along side of the pile. The load is placed on the platform, raised to the desired height and rolled off. The machine thus does away with excessive labor in lifting heavy packages.

Built like a stationary elevator with controller, automatic stop device and electric brake, the platform is always under the control of the operator. The machine is mounted on three wheels, has 50 feet of flexible conductor with suitable stage plug fitting receptacles placed at convenient points throughout the building. The uprights are hinged so as to knock down, and the entire frame work is of steel construction.

These machines are supplied in heights up to 20 feet in capacities of from 500 lbs. to 2,000 lbs., and for either direct or alternating current.

Data required for prices includes capacity, total height, total lift, height of hinge from floor and kind of current, with voltage, phase and cycles.

The manufacturers will send complete information and bulletin covering any type desired.

ECONOMY ENGINEERING CO., 58-66 N. Jefferson St., Chicago, Ill.

"SHELTON" VIBRATORS.

Shelton Hair Dryer.
Hot or cold air. weight 2¾ lbs. Put up in case. List price $30.00.

The Shelton Electro Co.'s new catalog is now ready showing a complete line of Portable and Pedestal vibratory apparatus. Sent free on request.

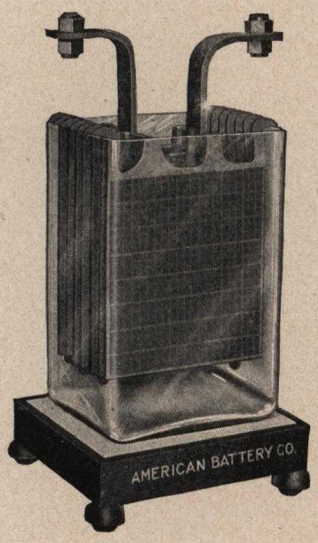
Wayne Vibrator.
Weight 2½ lbs. Rated vibration ⅛ H. P. Put up in case with 4 applicators. List price, $30.00.

Shelton Junior Vibrator.
Weight 3 lbs. Rated Vibration 1/6 H. P. Put up in case with 5 applicators. List price, $36.00.

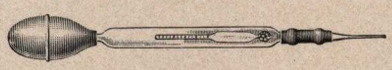
Shelton Vibrator.
Weight 3½ lbs. Rater Vibration ¼ H. P. Put up in case with 6 applicators. List price, $45.00.

SHELTON ELECTRIC CO., Chicago, U. S. A.

"American" Storage Battery and Rectifiers.



Type F.
American Storage Cell.



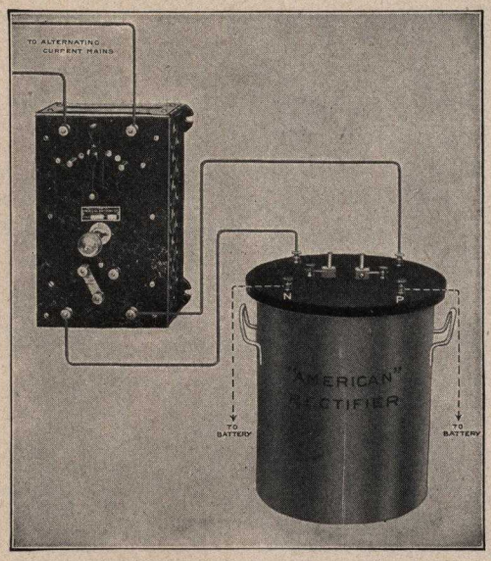
Storometer No. 1.
Combination Hydrometer and Syringe. Price $1.50.

"American" Storage batteries and "American" electrolytic rectifiers are made in a variety of sizes and styles to meet every possible demand.

STATIONERY BATTERIES for lighting, telephone, telegraph and power work of all descriptions.

PORTABLE BATTERIES for all the applications wherein batteries of this style are required.

STORAGE BATTERIES AND ACCESSORIES FOR RAILROAD SERVICE are especially designed for the work and made in any desired style with containers of rubber or lead; also special batteries for signal work.



Rectifier No. 63.
For charging storage batteries from an alternating current circuit. Capacity, 6 amperes.
Price $42.00.

ELECTROLYTIC RECTIFIERS are made in sizes that range in capacity from 2 to 30 amperes. Price $12.00 to $130.00. Performance guaranteed in all respects.

AMERICAN BATTERY COMPANY, 168 So. Clinton St., Chicago.
Established 1889.

1907

"NATIONAL ELECTRICAL CODE"

Rules and Requirements

of the

National Board of Fire Underwriters

For the Installation of

ELECTRIC WIRING

and

APPARATUS

As Recommended by the

Underwriters' National Electric Association

EDITION OF 1907

NOTE:—The rules governing marine work, car wiring and car houses, and construction of fittings and material—except wire and wooden mouldings—are omitted as possessing but limited interest.

The National Electrical Code was originally drawn in 1897 as the result of the united efforts of the various Insurance, Electrical, Architectural and allied interests which through the National Conference on Standard Electrical Rules, composed of delegates from various National Associations, unanimously voted to recommend it to their respective associations for approval or adoption; and is here presented by the National Board of Fire Underwriters with the various amendments and additions which have been made since that time by them.

The following is a list of the Associations composing the National Conference on Standard Electrical Rules:—

AMERICAN INSTITUTE OF ARCHITECTS.
AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.
AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
AMERICAN INSTITUTE OF MINING ENGINEERS.
AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION.
ASSOCIATED FACTORY MUTUAL FIRE INS. COMPANIES.
ASSOCIATION OF EDISON ILLUMINATING COMPANIES.
INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS.
NATIONAL BOARD OF FIRE UNDERWRITERS.
NATIONAL ELECTRIC LIGHT ASSOCIATION.
NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION.
NATIONAL ELECTRICAL INSPECTORS' ASSOCIATION.
UNDERWRITERS' NATIONAL ELECTRIC ASSOCIATION.

General Plan Governing the Arrangement of Rules

Class A.—**STATIONS AND DYNAMO ROOMS. Includes Central Stations; Dynamo, Motor, and Storage-Battery Rooms; Transformer Substations, etc.** Rules 1 to 11.

Class B.—**OUTSIDE WORK, all systems and voltages.** Rules 12 to 13 A.

Class C.—**INSIDE WORK:—**

General Rules, all systems and voltages. Rules 14 to 17.

Constant-Current Systems. Rules 18 to 20.

Constant Potential Systems:—

General Rules, all voltages. Rules 21 to 23.

Low-Potential Systems, 550 volts or less. Rules 24 to 34.

High-Potential Systems, 550 to 3500 volts. Rules 35 to 37.

Extra-High-Potential Systems, over 3500 volts. Rules 38 and 39.

Class D.—**FITTINGS, MATERIALS, AND DETAIL OF CONSTRUCTION, all systems and voltages.** Rules 40 to 47 and 50.

Class E.—**MISCELLANEOUS.** Rules 64 to 67.

The **Rules** are printed in large type, thus:—

c. Must be thoroughly insulated from the ground wherever feasible.

The **fine-print notes** belonging to the National Electrical Code are in the smaller fine type, thus:—

A high potential machine, which on account of great weight or for other reasons, cannot have its frame insulated from the ground, should be surrounded with an insulated platform.

The **explanatory notes** are printed in italics, thus:—

By "ground" is to be understood the earth, walls or floors of masonry, pipes of any kind, iron beams, and the like.

General Suggestions

In all electric, work, conductors, however well insulated, should always be treated as bare to the end that under no conditions, existing or likely to exist, can a ground or short circuit occur, and so that all leakage from conductor to conductor or between conductor and ground may be reduced to the minimum.

In all wiring special attention must be paid to the mechanical execution of the work. Careful and neat running, connecting, soldering, taping of conductors, and securing and attaching of fittings, are specially conducive to security and efficiency, and will be strongly insisted on.

In laying out an installation, except for constant current systems, every reasonable effort should be made to secure distribution centers located in easily accessible places, at which points the cutouts and switches controlling the several branch circuits can be grouped for convenience and safety of operation. The load should be divided as evenly as possible among the branches, and all complicated and unnecessary wiring avoided.

The use of wire-ways for rendering concealed wiring permanently accessible is most heartily endorsed and recommended; and this method of accessible concealed construction is advised for general use.

Architects are urged, when drawing plans and specifications, to make provision for the channeling and pocketing of buildings for electric light or power wires, and also for telephone, district messenger and other signaling system wiring.

Acknowledgment is gratefully made to the Associated Factory Mutual Fire Insurance Companies for many cuts and other material appearing in this section.

CLASS A.

Stations and Dynamo Rooms.

Includes Central Stations, Dynamo, Motor and Storage-Battery Rooms, Transformer, Substations Etc.

1. GENERATORS.

a. Must be located in a dry place.

It is recommended that water-proof covers be provided, which may be used in case of emergency.

If generators are allowed to become wet, there is likely to be more or less charring or burning of the cotton insulation of the wires, due to the fact that shellaced cotton will conduct electricity when wet. The current leaking over this moist conducting path, the resistance of which is being constantly decreased by the formation of copper salts by electrolytic action, may eventually develop excessive heat or even fusion of some of the metallic parts.

b. Must never be placed in a room where any hazardous process is carried on, nor in places where they would be exposed to inflammable gases or flyings of combustible materials.

Any generator, if badly designed, improperly handled, poorly cared for or overloaded, is liable to produce sparks, which may be of sufficient intensity to set fire to readily inflammable gases, dust, lint, oils and the like.

c. Must, when operating at a potential in excess of 550 volts, have their base frames permanently and effectively grounded.

Must, when operating at a potential of 550 volts or less, be thoroughly insulated from the ground wherever feasible. Wooden base frames used for this purpose, and wooden floors which are depended upon for insulation where, for any reason it is necessary to omit the base frames, must be kept filled to prevent absorption of moisture, and must be kept clean and dry

Where frame insulation is impracticable, the Inspection Department having jurisdiction may, in writing, permit its omission in which case the frame must be permanently and effectively grounded.

A high potential machine should be surrounded by an insulated platform. This may be made of wood, mounted on insulating supports, and so arranged that a man must always stand upon it in order to touch any part of the machine.

In case of a machine having an insulated frame, if there is trouble from static electricity due to belt friction, it should be overcome by placing near the belt a metallic comb connected with the earth, or by grounding the frame through a resistance of not less than 300,000 ohms.

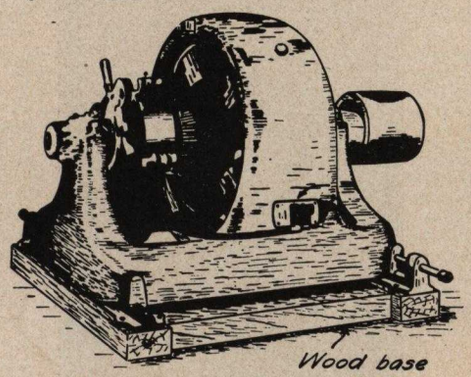


FIG. 1.—GENERATOR MOUNTED ON WOODEN BASE FRAME.

By "ground" is to be understood the earth, walls or floors of masonry, pipes of any kind, iron beams, and the like.

If frame insulation is not provided, a slight fault in the insulation of the magnet or armature coils is likely to ground the electric system and a short-circuit will then occur the instant another ground occurs at any point on the system.

The reason for requiring a positive ground wherever frame insulation is impracticable, is to provide a definite path for leak currents and thus prevent them from escaping at points where they might do harm. A good ground can be made by firmly attaching a wire to the dynamo frame and to any main water pipe that is thoroughly connected with underground pipes. The wire should not be smaller than No. 6 B. & S. gage and should be securely attached to the pipe by soldering it to a brass plug screwed into a fitting, or by binding it under a heavy split clamp, or by any other equally thorough method. With direct-connected units, the engine or water-wheel would generally furnish a sufficiently good ground.

It is best to provide a solid timber base-frame, even with a wooden floor, for it is difficult to be sure that even a dry floor will

1. Generators—Continued.

furnish perfect insulation, by reason of the many nails driven through it, the pipe hangers likely to be screwed into its under side and the many other possibilities of metallic connection to the ground. For the same reason, care should be taken that the bolts which hold the generator in place do not pass way through the base-frame, so as to come in contact with the floor.

The base-frame should raise the generator several inches above the floor level as a raised frame is more easily kept free from metal dust, dampness, etc., which may afford an opportunity for the escape of current to the ground. A hard and durable finish for the timber can be made by several coats of linseed oil and a finish coat of shellac or hard varnish.

When generators are direct-connected to engines or water-wheels, it is necessary to use an insulating coupling if the frames are to be insulated from the ground. The insulation of such couplings is not entirely reliable, as the vibrations, shocks and constant strain of driving, together with oil and dirt, are very liable to destroy the insulating material.

d. Constant potential generators, except alternating current machines and their exciters, must be protected from excessive current by safety fuses or equivalent devices of *approved* design,

For two-wire, direct-current generators, single pole protection will be considered as satisfying the above rule, provided the safety device is located in the lead not connected to the series winding. See Fig. 2. When supplying three-wire systems, the generators should be so arranged that these protective devices will come in the outside leads.

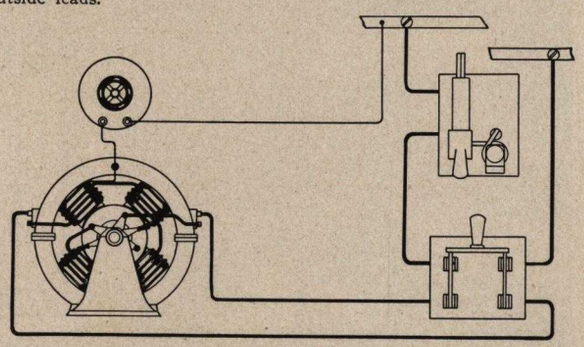


FIG. 2.—TWO WIRE, DIRECT CURRENT, GENERATOR WITH SINGLE PROTECTION.

For three-wire, direct-current generators, a safety device must be placed in each armature, direct-current lead, or a double pole, double trip circuit breaker in each outside generator lead and corresponding equalizer connection.

In general, generators should preferably have no exposed live parts and the leads should be well insulated and thoroughly protected against mechanical injury. This protection of the bare live parts against accidental contact would apply also to any exposed, uninsulated conductors outside of the generator and not on the switchboard unless their potential is practically that of the ground.

Where the needs of the service make the above requirements impracticable, the Inspection Department having jurisdiction may, in writing, modify them.

If this protection is not provided, an accidental short-circuit across the bus-bars or the exposed metal parts of the main switch on the switchboard is liable to result in the burning out of the armature.

Owing to inherent qualities possessed by the alternating current generator it is not considered necessary to protect it, especially as the quick opening of a protective device would be liable to give rise to momentary high voltage on the system.

e. Must each be provided with a name-plate, giving the maker's name, the capacity in volts and amperes, and the normal speed in revolutions per minute.

The name-plate shows exactly what the machine was designed for. Such information is often of great convenience, and also tends to prevent overrating, either from ignorance or from a desire to magnify the merits of a machine in order to help a sale.

f. Terminal blocks when used on gererators must be made of *approved* non-combustible, non-absorptive, insulating material, such as slate, marble or porcelain.

A reliable voltmeter should be provided on the switchboard, and it is best to have it so arranged as to show the voltage not only between the wires of opposite polarity, but also between each wire and the earth, thus serving as a very sensitive ground detector. *(See Appendix, page.)*

1. Generators—Continued.

See also note under Rule 2 e, page.

It is also advised that a reliable ammeter be provided with every constant-potential generator, and that it be clearly marked to indicate the full load of the machine. This instrument measures the amount of current given out by the generator and shows instantly if there is any undue load, such as would be produced if too many lamps were put in circuit, or if there were serious leakage of current at any point on the system. It is always desirable to have all generator ammeters on a switchboard so graduated that a full scale deflection corresponds to the same degree of overload on each, so that when several machines of different sizes are running in parallel, each machine will be doing its share of the work when the ammeter pointers are in similar positions.

2. Conductors.

From generators to switchboards, rheostats or other instruments, and then to outside lines:—

a. Must be in plain sight or readily accessible.

Wires from generator to switchboard may, however, be placed in a conduit in the brick or cement pier on which the generator stands, provided that proper precautions are taken to protect them against moisture and to thoroughly insulate them from the pier. If lead-covered cable is used, no further protection will be required, but it should not be allowed to rest upon sharp edges which in time might cut into the lead sheath, especially if the cables were liable to vibration. A smooth runway is desired. If iron conduit is provided, double braided rubber-covered wire (see No. 47) will be satisfactory.

Main conductors in immediate connection with the source of power must be treated as especially dangerous, because the whole capacity of the system would be concentrated in them should an arc start or an accidental short-circuit be made between them.

b. Must have an *approved* insulating covering as called for by rules in Class "C" for similar work, except that

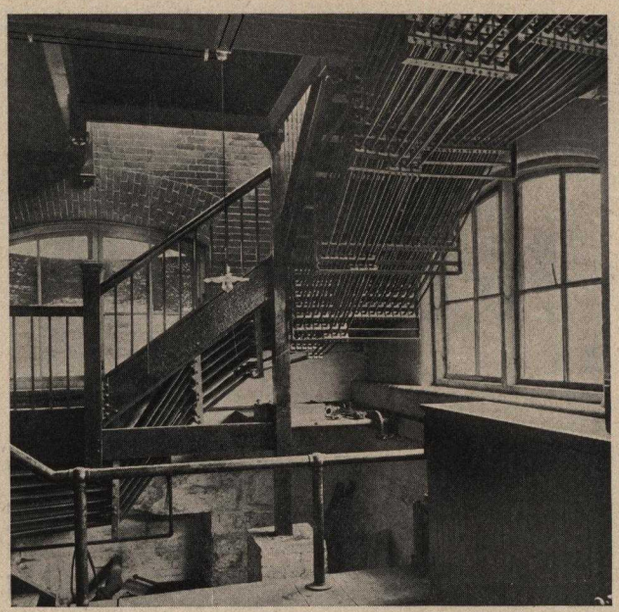


FIG. 3.—LARGE GROUP OF WIRES WELL SUPPORTED.

in central stations, on exposed circuits, the wire which is used must have a heavy braided, non-combustible outer covering.

Bus bars may be made of bare metal.

Rubber insulations ignite easily and burn freely. Where a number of wires are brought close together, as is generally the case in dynamo rooms, especially about the switchboard, it is therefore necessary to surround this inflammable material with a tight, non-combustible outer cover. If this is not done, a fire once started at this point would spread rapidly along the wires, producing intense heat and a dense smoke. Where the wires have such a covering and are well insulated and supported, using only non-combustible materials, it is believed that no appreciable fire hazard exists, even with a large group of wires.

Flame proofing should be stripped back on all cables a sufficient amount to give the necessary insulation distances for the voltage of the circuit on which the cable is used. The stripping back of the flame proofing is necessary on account of the poor insulating qualities of the flame proofing material now available. Flame proofing may be omitted where satisfactory fire proofing is accomplished by other means, such as compartments, etc.

Figure 3 illustrates very well the need of a slow-burning outer covering on the wires where they are grouped.

It is also recommended that all live parts of the switchboard, such as bus-bars and other conductors, be protected against accidental contact as far as practicable by suitable insulation, which shall be "flame proof" or "slow-burning" and designed to withstand

2. Conductors—Continued.

a reasonable amount of abrasion. The chances of accidental short-circuits may thereby be greatly reduced. Insulated cable for bus-bars and connections is excellent for this purpose. However, the conductors could be wrapped or taped if this should be found more convenient, but this method should never be used unless it can be done well. Due to the possibly rather low insulating properties of most fire-proofing compounds as used, special precautions would be necessary on high-voltage circuits to prevent current leakage over the outer fire-proofed covering.

c. Must be kept so rigidly in place that they cannot come in contact

It is necessary, also, to protect the wires against accidental blows from belt, or from ladders, etc., in the hands of careless workmen. This may be done in about the same manner as is recommended for wires on side walls. See Figs. 42, 43, 44 and 45.

d. Must in all other respects be installed with the same precautions as required by rules in Class "C" for wires carrying a current of the same volume and potential.

e. In wiring switchboards the ground detector, voltmeter, pilot lights and potential transformers must be connected to a circuit of not less than No. 14 B. & S. gage wire that is protected by an *approved* fuse, this circuit is not to carry over 660 watts.

For the protection of instruments and pilot lights on switchboards, *approved* N. E. Code Standard Enclosed Fuses are preferred, but *approved* enclosed fuses of other designs of *not over two (2) amperes capacity,* may be used.

Voltmeter switches having concealed connections must be plainly marked, showing connections made.

3. Switchboards.

a. Must be so placed as to reduce to a minimum the danger of communicating fire to adjacant combustible material.

It is often necessary, also, to protect the wires against accidental blows from belt, or from ladders, etc., in the hands of careless workmen. This may be done in about the same manner as is recommended for wires on side walls. (See Figs. 42, 43, 44, 45.)

Special attention is called to the fact that switchboards should not be built down to the floor, nor up to the ceiling. A space of at least ten or twelve inches should be left between the floor and the board, except when the floor about the switchboard is of con-

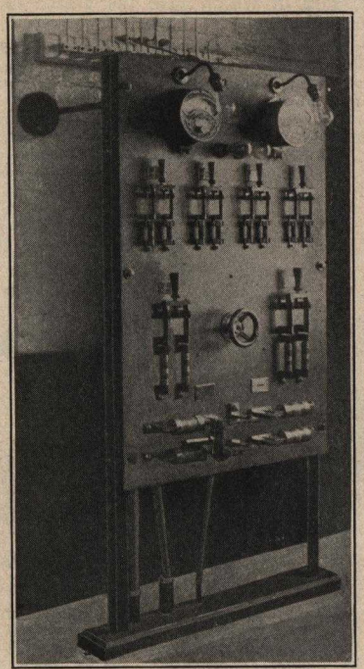


FIG. 4—WELL ARRANGED SWITCHBOARD.

crete or other fire proof construction, and a space of three feet, if possible, between the ceiling and the board, in order to prevent fire from communicating from the switchboard to the floor or ceiling, and also to prevent the forming of a partially concealed space very liable to be used for storage of rubbish and oily waste.

Great care in designing and locating a switchboard is necessary for several reasons; the rheostats, measuring instruments, fuses, etc., are possible sources of fire; there is a considerable number of bare live parts on the ordinary board which afford good opportunity for accidental short-circuits; and there is frequently a large amount of power available at the board to quickly follow up any trouble at this point.

3. Switchboards—Continued.

b. Must be made of non-combustible material or of hardwood in skeleton form, filled to prevent absorption of moisture.

If wood is used all wires and all current carrying parts of the apparatus on the switchboard must be separated therefrom by non-combustible, non-absorptive insulating material.

Switchboards of slate or marble are now mostly used. A slate board complete is but little more expensive than a properly wired and equipped wooden board in skeleton form. The non-combustible board is undoubtedly preferable, and is therefore strongly recommended, especially for the larger equipments.

The slate switchboard shown in Fig. 4 is an excellent example of a well-arranged modern board, equipped with all the necessary apparatus for controlling the output of one generator. Attention is called to the use of enclosed fuses on this board, also the location of the ground detector lamps, which brings them near together, so that any difference in brilliancy may be readily noted. All of the wiring on the back of this board has slow-burning weather-proof

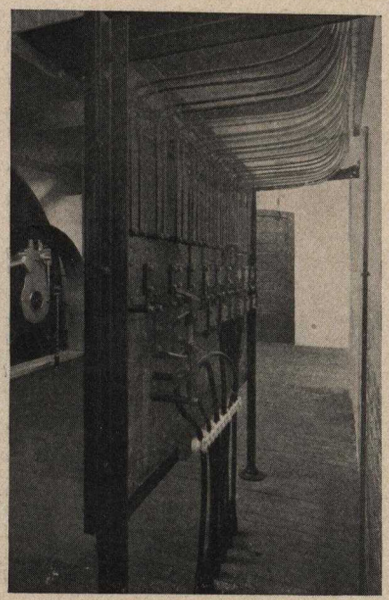


FIG. 5.—SLATE SWITCHBOARD NEATLY WIRED AND WELL LOCATED.

insulation (see Rule 43), thus securing the slow-burning feature recommended in Rule 2 b.

c. Must be accessible from all sides when the connections are on the back, but may be placed against a brick or stone wall when the wiring is entirely on the face.

If the wiring is on the back, there should be a clear space of at least eighteen inches between the wall and the apparatus on the board, and even if the wiring is entirely on the face, it is much better to have the board set out from the wall. The space back of the board should not be closed in, except by grating or netting either at the sides, top or bottom, as such an enclosure is almost sure to be used as a closet for clothing or for the storage of oil cans, rubbish, etc. An open space is much more likely to be kept clean, and is more convenient for making repairs, examinations, etc.

This point is well illustrated by Fig. 5, which shows the back of a slate switchboard, neatly wired and well located. Every part of this board is easily accessible, and all necessary repairs can be made with very little chance of deranging the wires or causing short-circuits across the parts such as are liable to occur in cramped quarters. By insulating the bus-bars and other bare conductors, as mentioned in Rule 2 b, the liability of accidental short-circuits at this point could be largely avoided.

d. Must be kept free from moisture.

Water on a switchboard is liable to produce serious trouble, as it is almost certain to start leaks over the surface of the insulating coverings on the wires and over the board itself; for water-soaked insulators, or a film of water on a non-absorptive insulator, like glass, porcelain or hard rubber, will conduct electricity to some extent. By electrolytic action this leakage current will form salts of copper over the surface of the insulating parts, and as these salts are good conductors, the leakage current will be increased, resulting in the inevitable destruction of the weakest part, be it insulation, wire or dynamo. Under such conditions there would also be great danger of the attendant receiving severe shocks.

e. On switchboards the distances between bare live parts of opposite polarity must be made as great as practicable, and must not be less than those given for tablet-boards.

4. Resistance Boxes and Equalizers.

a. Must be placed on switchboard, or if not thereon, at a distance of at least one foot from combustible material, or separated therefrom by non-combustible, non-absorptive insulating material such as slate or marble.

4. Resistance Boxes and Equalizers—Continued.

This will require the use of a slab or panel of non-combustible, non-absorptive insulating material such as slate or marble, somewhat larger than the rheostat, which shall be secured in position independently of the rheostat supports. Bolts for supporting the rheostat shall be countersunk at least ⅛ inch below the surface at the back of the slab and filled. See Fig. 6. For proper mechanical strength, slab should be of a thickness consistent with the size and weight of the rheostat, and in no case to be less than ½ inch.

If resistance devices are installed in rooms where dust or combustible flyings would be liable to accumulate on them, they should be equipped with a dustproof face plate.

Resistance boxes should be considered as stoves, which under some conditions may become red hot, and from which drops of heated metal may fall, or even be thrown some distance.

Motor-starting rheostats, arc lamp compensators, electric heaters and the like would all come under this rule unless so designed as to make these precautions unnecessary for the desired safety.

b. Where protective resistances are necessary in connection with automatic rheostats, incandescent lamps may be used, provided that they do not carry or control the main current nor constitute the regulating resistance of the device.

When so used, lamps must be mounted in porcelain receptacles upon non-combustible supports, and must be so arranged that they cannot have impressed upon them a voltage greater than that for which they are rated. They must in all cases be provided with a name-plate, which shall be permanently attached beside the porcelain receptacle or receptacles and stamped with the candle-power and voltage of the lamp or lamps to be used in each receptacle.

c. Wherever insulated wire is used for connection between resistances and the contact plate of a rheostat, the insulation must be slow burning (see No. 43.) For large field rheostats and similar resistances, where the contact plates are not mounted upon them, the connecting wires may be run together in groups so arranged that the maximum difference of potential between any two wires in a group shall not exceed 75 volts. Each group of wires must either be mounted on non-combustible, non-absorptive insulators giving at least half-inch separation from surface wired over or, where it is necessary to protect the wires from mechanical injury or moisture, be run in approved lined conduit or equivalent.

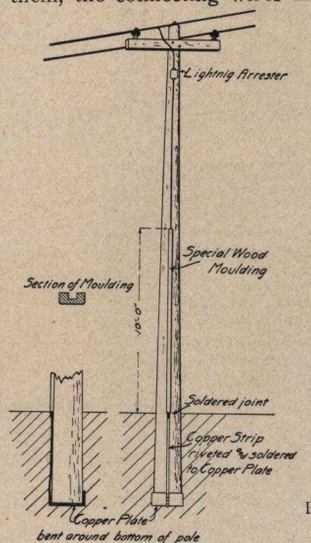


FIG. 7.—GROUND CONNECTION FOR LINE LIGHTNING ARRESTER.

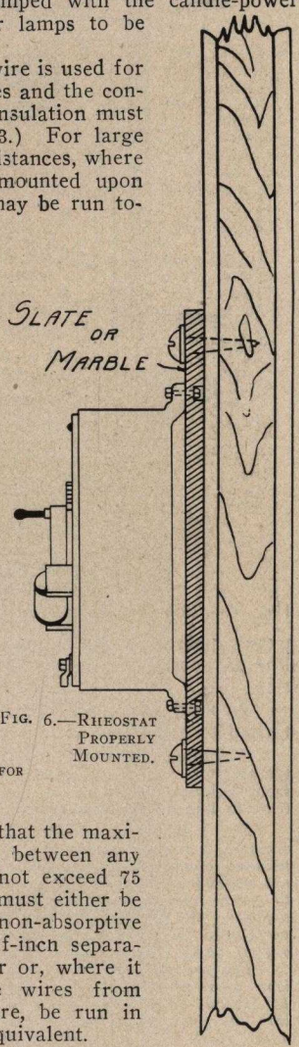


FIG. 6.—RHEOSTAT PROPERLY MOUNTED.

5. Lightning Arresters.

a. Must be attached to each wire of every overhead circuit connected with the station.

It is recommended to all electric light and power companies that arresters be connected at intervals over systems in such numbers and so located as to prevent ordinary discharges entering (over the wires) buildings connected to the lines. See Fig. 7.

5. Lightning Arresters—Continued.

The kind and degree of protection necessary depend largely on circumstances. A short outdoor line from one mill building to another will often require nothing, while a long overhead line through an open exposed country will generally need the most careful engineering to secure reasonable freedom from lightning disturbances.

b. Must be located in readily accessible places away from combustible materials, and as near as practicable to the point where the wires enter the building.

In all cases, kinks, coils and sharp bends in the wires between the arresters and the outdoor lines must be avoided as far as possible.

The switchboard does not necessarily afford the only location meeting these requirements. In fact, if the arresters can be located in a safe and accessible place away from the board, this should be done, for, in case the arrester should fail or be seriously damaged there would then be less chance of starting arcs on the board.

The arresters should be accessibly located, so that they may be easily examined from time to time, and should always be isolated from combustible materials, as sparks are sometimes produced when lightning is discharged through them.

Kinks, coils, sharp bends, etc., may offer enormous resistance to a lightning current, possibly preventing its discharge to ground through the arrester and causing it to leave the wires at some other point, where it might do considerable damage.

c. Must be connected with a thoroughly good and permanent ground connection by metallic strips or wires having a conductivity not less than that of a No. 6 B. & S.

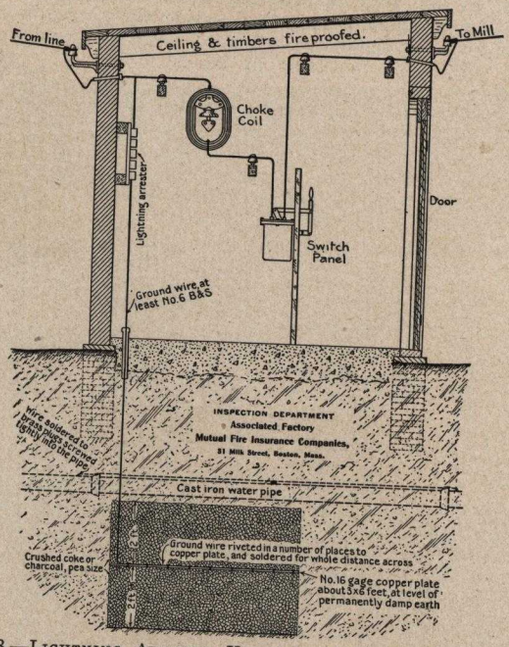


FIG. 8.—LIGHTNING ARRESTER HOUSE WITH GROUND CONNECTION.

gage copper wire, which must be run as nearly in a straight line as possible from the arresters to the ground connection.

Ground wires for lightning arresters must not be attached to gas pipes within the buildings.

It is often desirable to introduce a choke coil in circuit between the arresters and the dynamo. In no case should the ground wires from lightning arresters be put into iron pipes, as these would tend to impede the discharge.

Fig. 7 shows a convenient way of making a ground for a line arrester, it being assumed that there are a number of arresters distributed along the line, so that the protection of the system does not depend entirely on this one ground. In general, it is desirable to place from two to five arresters per mile, depending on the exposure and general situation of the line. In locating arresters, preference should be given to those places where earth which is always damp can be most easily and surely reached.

The ground connection shown in the cut consists of galvanized iron pipe with a nominal outside diameter of at least 1 inch. It should be in one piece if possible, and should be driven into the ground at least 8 feet, or even further if permanently damp earth is not found at that depth. If, however, it should prove impossible to drive the pipe far enough to reach earth that would surely be permanently damp, a small hole should be dug around it to a depth of 4 or 5 feet, and it should then be driven as far as possible and the hole filled with crushed coke or charcoal about pea size. This improves the connection between the pipe and the earth, thus tending to make up for the lack of moisture.

The pipe should extend above the ground for a distance of at least 7 feet, and the ground wire should be soldered to a brass plug screwed with considerable force into a coupling at the top

Lightning Arresters—Continued.

of it. The wire must never be put inside the pipe, as this would tend to impede the lightning discharge. Both pipe and wire should be firmly fastened to the pole with strong staples, so as to guard against the ground connection being broken. The wire should be kept as straight as possible for the reason given in the note to Rule 5 b, the only bend in it being that necessary to form the drip loop.

For a group of arresters, such as might exist in a station, or in a lightning arrester house at the end of a long line, a more elaborate ground would be desirable, and for this work an excellent connection can be made in the manner shown in Fig. 8. The lightning arrester, choke coil, switch, etc., shown in the cut may be considered to represent one of several sets, each wire entering the house being fully equipped in the same manner. (A separate wire may be carried from each arrester to the copper plate, or two main wires, not smaller than No. 0 B. & S. gage each, may be used, the ground wires from the separate arresters running in the most direct line possible to these mains and being firmly soldered to them.

The copper plate and coke or charcoal would ordinarily make a sufficiently good ground, but it is desirable to also connect to an underground water pipe, if one is near. There is no danger of getting too good a ground. The surest way to secure a good connection with a pipe is to tap a hole part way through it, and forcibly screw into the hole a brass plug to which the wire has been soldered. The joint should then be covered with waterproof paint and taped, to prevent corrosion. It is best to connect to several lengths of pipe, as the lightning discharge is thus distributed over several points. A better ground is also obtained, as pipe joints are liable to offer considerable resistance. It is not desirable, however, to connect to pipes which enter and ramify through a building, such as sprinkler pipes, at a point nearer than 50 to 75 feet from the building; neither is it best to have the ground connection for a large bank of arresters located very near buildings or near pipes which enter them.

The lightning arresters should be inspected frequently, to be sure that they are in proper condition. This is especially necessary during the summer season, when lightning storms are most liable to occur. It is also of the greatest importance to maintain an excellent ground connection for the arresters, as the efficiency of the protection is absolutely dependent upon this feature. The entire ground connection should therefore be uncovered and carefully examined at least once a year, preferably in the spring, in order to positively know that the connection has not been impaired by corrosion or other accident and that the earth in the vicinity of the ground plate or pipe is still damp, so that the equipment is in proper shape for the season's work.

Choke coils and lightning arresters are arranged in different ways, depending on the exact conditions in any given case. Fig. 8, however, shows the usual arrangement, although two or more such combinations of choke coil and arrester are sometimes connected in series in each wire; again, a number of choke coils may be placed in series back of a single arrester, etc. The choke coil acts like a dam and tends to prevent lightning currents from passing through it, thus compelling them to go through the arrester to the ground. Choke coils are made in various forms but practically all consist of a coil of several turns of insulated conductor. As little combustible material as possible should be used in their construction and also for their supports.

Where the house contains considerable value in arresters, choke coils, switches, etc., it should be built of brick with a fireproof plank roof and concrete floor, so as to reduce the chances of fire to a minimum. The plank roof is suggested instead of concrete or brick arched construction because it is less expensive and is believed to be good enough in most cases if properly protected. For very large equipments, fireproof construction should be used throughout the building. Where brick is not considered necessary, a wooden building of plank and timber is advised, and all light and flimsy woodwork should be avoided.

The arrester house would generally be an excellent place for the emergency switch, as this building would usually be located well away from the other buidings and would thoroughly protect the switch against the weather. In such cases, therefore, the switch shown should be arranged for this purpose. For suggestions regarding the emergency switch, see note to Rule 22 a.

d. All choke coils of other attachments, inherent to the lightning protection equipment, shall have an insulation from the ground or other conductors equal at least to the insulation demanded at other points of the circuit in the station.

6. Care and Attendance.

a. A competent man must be kept on duty where generators are operating.

b. Oily waste must be kept in *approved* metal cans and removed daily.

Approved waste cans shall be made of metal with legs raising can three inches from the floor, and with self-closing covers.

7. Testing of Insulation Resistance.

a. All circuits except such as are permanently grounded in accordance with No. 13 A must be provided with reliable ground detectors. Detectors which indicate continuously and give an instant and permanent indication of a ground are preferable. Ground wires from detectors must not be attached to gas pipes within the building.

b. Where continuously indicating detectors are not feasible, the circuits should be tested at least once per day, and preferably oftener.

7. Test of Insulation Resistance—Continued.

c. Data obtained from all tests must be preserved for examination by the Inspection Department having jurisdiction.

These rules on testing to be applied at such places as may be designated by the Inspection Department having jurisdiction.

8. Motors.

The use of motors operating at a potential in excess of 550 volts will only be approved when every practicable safeguard has been provided. Plans for such installations should be submitted to the Inspection Department having jurisdiction before any work is begun.

a. Must, when operating at a potential in excess of 550 volts, have no exposed live metal parts, and have their base frames permanently and effectively grounded.

Motors operating at a potential of 550 volts or less must be thoroughly insulated from the ground where feasible. Wooden base frames used for this purpose, and wooden floors, which are depended upon for insulation where, for any reason, it is necessary to omit the base frames, must be kept filled to prevent absorption of moisture, and must be kept clean and dry. Where frame insulation is impracticable, the Inspection Department having jurisdiction may, in writing, permit its omission, in which case the frame must be permanently and effectively grounded.

FIG. 9.—INDUCTION MOTOR ON CEILING WITH STARTING SWITCH ENCLOSED IN CABINET AND OPERATED BY OUTSIDE HANDLE.

A high-potential machine should be surrounded with an insulated platform. This may be made of wood, mounted on insulating supports, and so arranged that a man must stand upon it in order to touch any part of the machine.

In case of a machine having an insulated frame, if there is trouble from static electricity due to belt friction, it should be overcome by placing near the belt a metallic comb connected to the earth, or by grounding the frame through a resistance of not less than 300,000 ohms.

b. Motors operating at a potential of 550 volts or less must be wired with the same precautions as required by rules in Class "C" for wires carrying a current of the same volume.

Motors operating at a potential between 550 and 3,500 volts must be wired with approved multiple conductor, metal sheathed cable in approved unlined metal conduit firmly secured in place. The metal sheath must be permanently and effectively grounded, and the installation of the conduit must conform to rules for interior conduits (see Rule 25), except that at outlets approved outlet bushings shall be used.

8. Motors—Continued.

The motor leads or branch circuits must be designed to carry a current at least 25 per cent greater than that for which the motor is rated, in order to provide for the inevitable occasional overloading of the motor and the increased current required in starting, without overfusing the wires; but where the wires under this rule would be overfused, in order to provide for the starting current, as in the case of many of the alternating current motors, the wires must be of such size as to be properly protected by these larger fuses.

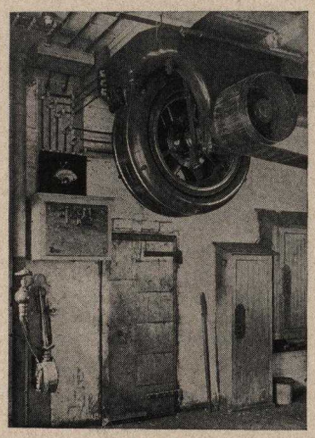


FIG. 10.—INDUCTION MOTOR ON CEILING.

The insulation of the several conductors for high potential motors, where leaving the metal sheath at outlets must be thoroughly protected from moisture and mechanical injury. This may be accomplished by means of a pot head or some equivalent method. The conduit must be substantially bonded to the metal casings of all fittings and apparatus connected to the inside high tension circuit. It would be much preferable to make the conduit system continuous throughout by connecting the conduit to fittings and motors by means of screw joints, and this construction is strongly recommended wherever practicable.

High potential motors should preferably be so located that the amount of inside wiring will be reduced to a minimum.

Inspection Departments having jurisdiction may permit the wire for high potential motors to be installed according to the general rules for high potential systems when the outside wires directly enter a motor room (see Section *f*). Under these conditions there would generally be but a few feet of wire inside the building and none outside the motor room.

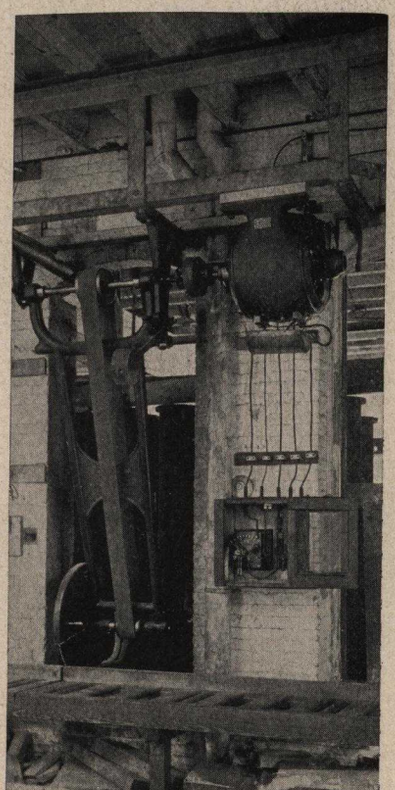


FIG. 11.—ENCLOSED DIRECT CURRENT MOTOR WITH SWITCH, FUSES, RHEOSTAT, ETC., ENCLOSED IN CABINET.

8. Motors—Continued.

c. Each motor and resistance box must be protected by cut-out and controlled by a switch (see No. 17 *a*), said switch plainly indicating whether "on" or "off." With motors of one-fourth horse power or less on circuits where the voltage does not exceed 330, Rule 21 *d* must be complied with and single pole switches may be used as allowed in No. 22 *c*. The switch and rheostat must be located within sight of the motor, except in cases where special permission to locate them elsewhere is given, in writing, by the inspection Department having jurisdiction.

The use of circuit-breakers with motors is recommended, and may be required by the Inspection Department having jurisdiction.

Where the circuit-breaking device on the motor-starting rheostat disconnects all wires of the circuit, the switch called for in this section may be omitted.

Overload-release devices on motor-starting rheostats will not be considered to take the place of the cut-out required by this section if they are inoperative during the starting of the motor.

The switch is necessary for entirely disconnecting the motor when not in use, and the cut-out to protect the motor from excessive currents due to accidents or careless handling when starting. An automatic circuit-breaker disconnecting all wires of the circuit may, however, serve as both switch and cut-out.

In general, motors should preferably have no exposed live parts.

Fig. 10 shows an automatic circuit-breaker used in this way for both switch and cut-out.

d. Rheostats must be so installed as to comply with *all* the requirements of No. 4. Auto starters must comply with requirments of No. 4 *c*.

Starting rheostats and auto starters. unless equipped with tight casings enclosing all current-carrying parts, should be treated about the same as knife switches, and in all wet, dusty or linty places, should be enclosed in dust-tight, fireproof cabinets. If a special motor room is provided, the starting apparatus and safety devices should be included within it. Where there is any liability of short circuits across their exposed live parts being caused by accidental contacts, they should either be enclosed in cabinets, or else a railing should be erected around them to keep unauthorized persons away from their immediate vicinity.

e. Must not be run in series-multiple or multiple-series, except on constant-potential systems, and then only

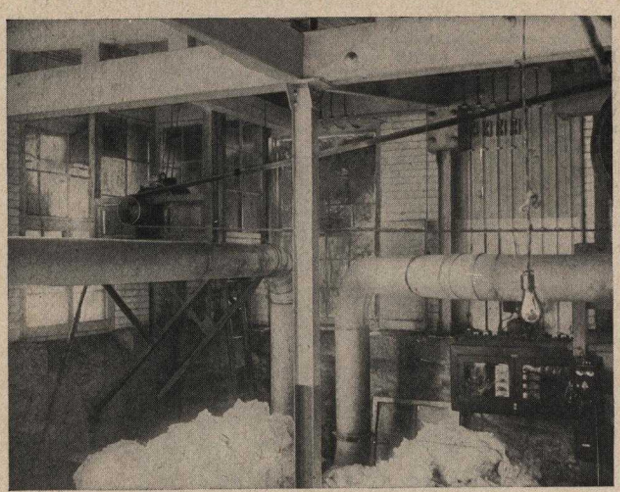


FIG. 12.—MOTOR ON SHELF ENCLOSED IN GLASS CASE AND REACHED BY LADDER, WITH AUTO-STARTER IN CABINET.

by special permission of the Inspection Department having jurisdiction.

The objection to combinations of this character is that the cutting-out of one motor, by accident or carelessness, may subject the others to a current or voltage greater than that for which they are designed; and if this occurs, and the protecting devices fail, as sometimes happens, there is very likely to be severe arcing, or a burn-out.

f. Must be covered with a water-proof cover when not in use, and if deemed necessary by the Inspection Department having jurisdiction, must be enclosed in an *approved* case.

When it is necessary to locate a motor in the vicinity of combustibles or in wet or very dusty or dirty places, it is generally advisable to enclose it as above.

Such enclosures should be readily accessible, dust proof and sufficiently ventilated to prevent an excessive rise of temperature. The sides should preferably be made largely of glass, so that the motor may be always plainly visible. This lessens the chance of its being neglected, and allows any derangement to be at once noticed.

8. Motors—Continued.

The use of enclosed type motor is recommended in dusty places, being preferable to wooden boxing.

From the nature of the question the decision as to details of construction must be left to the Inspection Department having jurisdiction to determine in each instance.

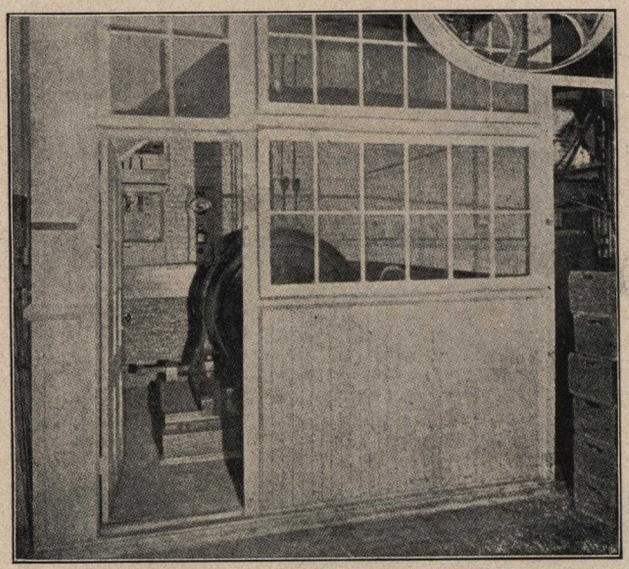


FIG. 13. WELL ARRANGED MOTOR ROOM.

If possible, the enclosure should be large enough to permit the attendant to enter it and easily get at any part of the apparatus, and this would generally mean a small room, such as is shown in Fig. 13. If the motor is suspended from the ceiling, a floor could generally be constructed below it and the four sides of this elevatd motor room could be built mainly of windows. Ready access to the room could be secured by means of a short flight of stairs or a ladder. This can also be done where the motor is supported on an elevated platform as shown in Fig. 12.

With alternating-current motors having no brushes, the enclosure would generally be unnecessary, especially when suspended from the ceiling, as shown in Figs. 9 and 10. When located on the floor, it would often be advisable to surround the machine by a substantial pipe rail to keep people from passing near it.

g. Must, when combined with ceiling fans, be hung from insulated hooks, or else there must be an insulator interposed between the motor and its support. (See Fig. 14.)

For the same reasons as given in the note to Rule 1 c.

h. Must each be provided with a name-plate, giving maker's name, the capacity in volts and amperes, and the normal speed in revolutions per minute.

For the same reasons as given in the note to Rule 1 e.

i. Terminal blocks when used on motors must be made of *approved* non-combustible, non-absorptive, insulating material such as slate, marble or porcelain.

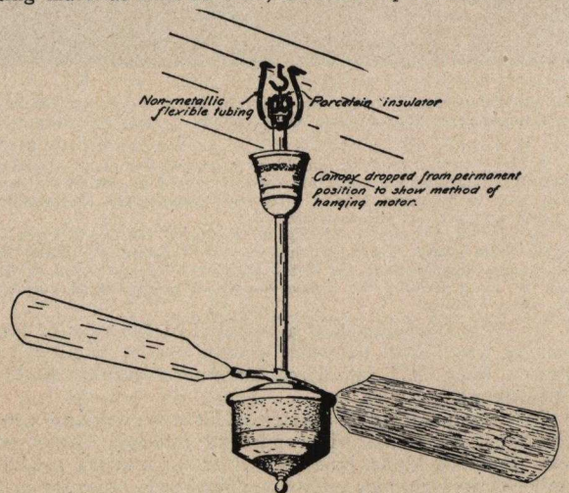


FIG. 14. FAN MOTOR PROPERLY SUSPENDED.

j. Variable speed motors, unless of special and appropriate design, if controlled by means of field regu-

8. Motors—Continued.

lation, must be so arranged and connected that they cannot be started under weakened field.

9. Railway Power Plants.

a. Each feed wire before it leaves the station must be equipped with an *approved* automatic circuit-breaker or other device, which will immediately cut off the current in case of an accidental ground. This device must be

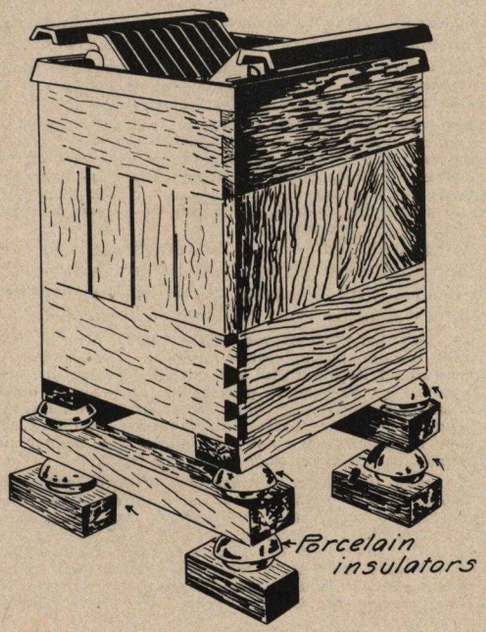


FIG. 15. STORAGE BATTERY SHOWING USUAL METHOD OF SETTING UP.

mounted on a fire proof base, and in full view and reach of the attendant.

An automatic circuit-breaker is preferable to a fuse, as it acts more quickly, is more reliable, and can be more quickly and safely replaced.

10. Storage or Primary Batteries.

a. When the current for light and power is taken from primary or secondary batteries, the same general regulations must be observed as apply to similar apparatus fed from dynamo generators developing the same difference of potential.

Charged storage batteries have in them at all times a large amount of stored energy, and should therefore be treated as carefully as generators of similar output.

b. Storage battery rooms must be thoroughly ventilated.

The action of the current in charging the battery liberates at times large quantities of hydrogen and oxygen, and if these should accumulate in the right proportions they would form an explosive mixture which might be exploded by any accidental spark.

c. Special attention is directed to the rules for wiring in rooms where acid fumes exist (see No. 24, *i* and *j*.)

d. All secondary batteries must be mounted on non-absorptive, non-combustible insulators, such as glass or thoroughly vitrified and glazed porcelain. (See Fig. 15.)

The battery needs to be insulated for the same reasons as given in the note to Rule 1c, and nothing but glass, porcelain and similar materials will retain their insulating properties when exposed to the action of the water and acid freely used about storage batteries.

e. The use of any metal liable to corrosion must be avoided in cell connections of secondary batteries.

Reduction of the cross-section of the connections by corrosion would probably cause them to be burned out by the normal current of the battery.

11. Transformers.

(*See also Rules 13, 13A, 36.*)

a. In central or sub-stations the transformers must be so placed that smoke from the burning out of the coil or the boiling over of the oil (where oil filled cases are used) could do no harm.

If the insulation in a transformer breaks down, considerable heat is likely to be developed. This would cause a dense smoke, which might be mistaken for a fire and result in water being thrown into the building, and a heavy loss thereby entailed. Moreover, with oil-cooled transformers, especially if the cases are filled too full, the oil may become ignited and boil over, producing a very stubborn fire.

b. In central or sub-stations casings of all transformers must be permanently and effectively grounded.

Transformers used exclusively to supply current to switchboard instruments need not be grounded, provided they are thoroughly insulated.

While from a fire standpoint it is not considered necessary to ground the casings of instrument transformers above mentioned, it is believed advisable to ground them in order to guard against danger from shock. It is evident that all other metal work such as switchboard frames, instrument cases, etc., which are liable to come in contact with a live circuit should also be grounded to protect against this danger.

CLASS B.

OUTSIDE WORK.

(*Light, Power and Heat. For Signaling Systems, see Class E.*)

ALL SYSTEMS AND VOLTAGES.

12. Wires.

a. Line wires must have an *approved* weatherproof or rubber insulating covering (see No. 44 and No. 41). That portion of the service wires between the main cut-out and switch and the first support from the cut-out or switch on outside of the building must have an approved rubber insulating covering (see No. 41), but from the above-mentioned support to the line, may have an approved weatherproof insulating covering (see No. 44), if kept free from awnings, swinging signs, shutters, etc.

b. Must be so placed that moisture cannot form a cross connection between them, not less than a foot apart, and not in contact with any substance other than their insulating supports. Wooden blocks to which insulators are attached must be covered over their entire surface with at least two coats of waterproof paint.

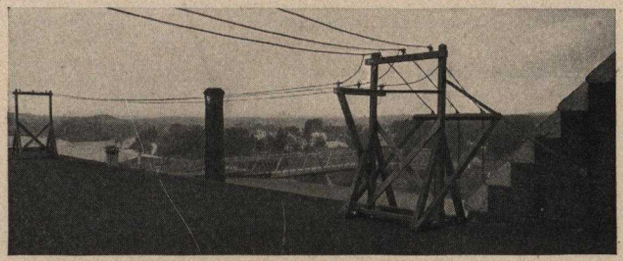


FIG. 16. SUBSTANTIAL WOODEN ROOF STRUCTURES.

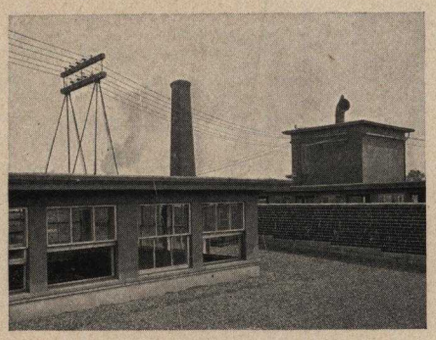


FIG. 17. IRON PIPE ROOF STRUCTURE.

To prevent water from forming a short-circuit, as well as to guard against actual contact produced by the swaying of the wires by the wind.

12. Wires—Continued.

c. Must be at least seven feet above the highest point of flat roofs, and at least one foot above the ridge of pitched roofs over which they pass or to which they are attached.

Roof structures are frequently found which are too low or much too light for the work, or which have been carelessly put up. A structure which is to hold the wires a proper distance above the roof in all kinds of weather must not only be of sufficient height, but must be substantially constructed of strong material.

This rule is intended to insure that under no conditions could the wires sag and touch the roof; and also that persons walking on the roofs could not come into accidental cantact with them.

Fig. 16 shows two good examples of durable wooden roof structures holding the wires well out of the reach of persons on the roof. Fig. 17 shows a roof structure made of iron rods or pipes. This form of construction can easily be made sufficiently strong, and presents a somewhat neater appearance than the timber frame. The mtal work should, of course, be kept painted to protect it against corrosion.

d. Must be protected by dead insulated guard irons or wires from possibility of contact with other conducting wires or substances to which current may leak. Special

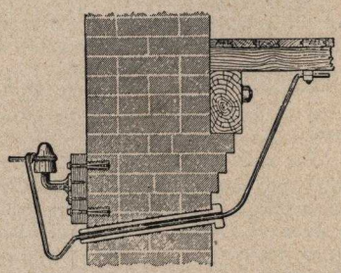


FIG. 18. ENTRANCE BUSHING AND DRIP LOOP.

precautions of this kind must be taken where sharp angles occur, or where any wires might possibly come in contact with electric light or power wires.

Crosses, when unavoidable, should be made as nearly at right angles as possible.

If these guards are not provided, the breaking or sagging of a wire may result in contacts which might charge one set of wires with a higher voltage than that for which they were designed, and thus be liable to cause fire or endanger life.

e. Must be provided with petticoat insulators of glass

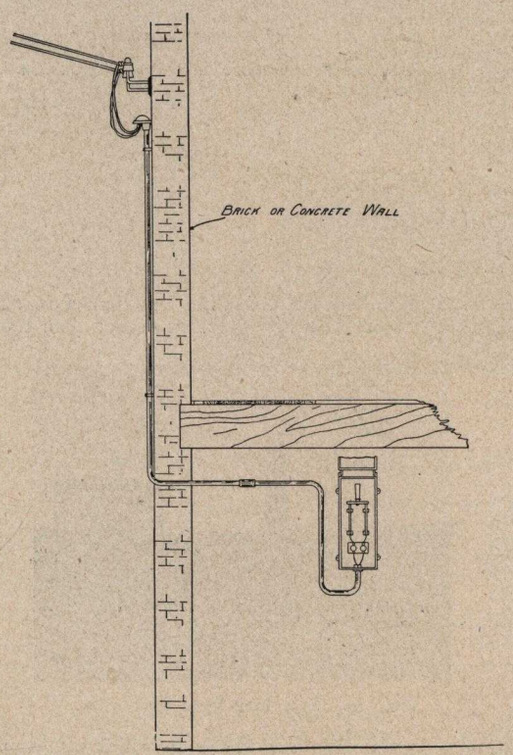


FIG. 19. SERVICE WIRES ENTERING THE BASEMENT OF A BRICK BUILDING.

or porcelain. Porcelain knobs or cleats and rubber hooks will not be approved.

12. Wires—Continued.

The surface of porcelain knobs or cleats is not free from moisture during a rain, and they are therefore, of practically no use as insulators in wet weather. A petticoat insulator, like those shown in Fig. 18, will nearly always have a dry space underneath its umbrella-like lower edge, and even if not dry, the length of the path offered to an escaping current is so great that the leakage would be small.

f. Must be so spliced or joined as to be both mechanically and electricially secure without solder. The joints must then be soldered, to insure preservation, and covered with an insulation equal to that on the conductors.

All joints must be soldered, unless made with some form ot *approved* splicing device. This ruling applies to joints and splices in all classes of wiring covered by these rules.

An unsoldered joint is liable to become loosened or corroded, in either of which events the contact between the wires would become imperfect. This would cause heating at the joint and might result in the wire being completely melted off and a dangerous arc being formed at the break. A good mechanical joint is required for strength, should the soldering give way or become corroded by traces of acid in the soldering fluid used.

g. Must, where they enter buildings, have drip loops outside, and the holes through which the conductors pass must be bushed with non-combustible, non-absorptive, insulating tubes slanting upward toward the inside.

For low potential systems the service wires may be brought into buildings through a single iron conduit. The conduit to be curved downward at its outer end and carefully sealed or equipped with an approved service-head to prevent the entrance of moisture. The outer end must be at least one foot from any woodwork and the inner end must extend to the service cut-out, and if a cabinet is required by the Code must enter the cabinet in a manner similar to that described in fine print note under No. 25 *b*.

Fig. 18 shows the proper arrangement of drip loop, bushing, etc., for wires entering buildings from outside. The insulator should be supported on a stout arm, which, for heavy wires or long spans, may need to be held in place by bolts passing entirely through the wall, rather than by expansion, bolts, as shown in the sketch. With a very thick wall, the method of bushing shown in Fig. 30, could be used. In that case, however, some means should be provided to prevent the lower porcelain tube from slipping out of the iron pipe.

h. Electric light and power wires must not be placed on the same cross-arm with telegraph, telephone or similar wires, and when placed on the same pole with such wires the distance between the two inside pins of each cross-arm must not be less than 26 inches.

This distance between the two inside pins is necessary to allow a man to safely pass between the wires and reach the cross-arms above.

i. The metallic sheaths to cables must be permanently and effectively connected to "earth."

Any breakdown of insulation between the conductor and the sheath makes the cable practically a bare live wire, the dangerous condition of which is obvious. The ground connection required by this section keeps the sheath at the potential of the earth and prevents a flow of current from the sheath at any other point than through the ground wire, which should be of sufficient size and so well connected to the sheath and to the earth that it could safely carry the current necessary to melt the fuse protecting the cable.

Trolley Wires.

j. Must not be smaller than No. 0 B. & S. gage copper or No. 4 B. & S. gage silicon bronze, and must readily stand the strain put upon them when in use.

k. Must have a double insulation from the ground. In wooden pole construction the pole will be considered as one insulation.

l. Must be capable of being disconnected at the power plant, or of being divided into sections, so that, in case of fire on the railway route. the current may be shut off from the particular section and not interfere with the work of the firemen. This rule also applies to feeders.

m. Must be safely protected against accidental contact where crossed by other conductors.

Guard wires should be insulated from the ground and should be electrically disconnected in sections of not more than 300 feet in length.

Ground Return Wires.

n. For the diminution of electrolytic corrosion of underground metal work, ground return wires must be so arranged that the difference of potential between the grounded dynamo terminal and any point on the return circuit will not exceed twenty-five volts.

It is suggested that the positive pole of the dynamo be connected to the trolley line, and that whenever pipes or other underground metal work are found to be electrically positive to the rails or surrounding earth, that they be connected by conductors arranged so as to prevent as far as possible current flow from the pipes into the ground.

12A. Constant-Potential Pole Lines, Over 5,000 Volts.

Overhead lines of this class unless properly arranged may increase the fire loss from the following causes:—

Accidental crosses between such lines and low-potential lines may allow the high-voltage current to enter buildings over a large section of adjoining country. Moreover, such high-voltage lines, if carried close to the buildings, hamper the work of the firemen in case of fire in the building. The object of these rules is so to direct this class of construction that no increase in fire hazard will result, while at the same time care has been taken to avoid restrictions which would unreasonably impede progress in electrical development.

It is fully understood that it is impossible to frame rules which will cover all conceivable cases that may arise in construction work of such an extended and varied nature, and it is advised that the Inspection Department having jurisdiction be freely consulted as to any modification of the rules in particular cases.

a. Every reasonable precaution must be taken in arranging routes so as to avoid exposure to contacts with other electric circuits. On existing lines, where there is a liability to contact, the route should be changed by mutual agreement between the parties in interest wherever possible.

It is evident that this is the very best way to guard against the accidental crosses above mentioned, and, therefore, it is strongly urged that every reasonable effort be made to secure the arrangment of the circuits.

b. Such lines should not approach other pole lines nearer than a distance equal to the height of the taller pole line, and such lines should not be on the same poles with other wires, except that signaling wires used by the Company operating the high-pressure system, and which do not enter property other than that owned or occupied by such Company, may be carried over the same poles.

It will be readily seen that if the taller pole should break near the ground and should fall toward the lower line, the upper line would strike the lower one unless the distance between the two lines was at least as great as the height of the taller pole.

It would be practically impossible to so arrange and guard the two sets of wires, if on the same line of poles, that all liability of contact between the wires would be absolutely avoided, and, therefore, separate pole lines should be provided wherever possible.

An exception to this rule which must frequently be made is the case of the signaling wires of the electric company, since an additional pole line for these circuits would often be impracticable. However, it should be noted that these wires enter but comparatively few buildings, which, moreover, in most cases, are already subject to the hazard of the high-voltage current, and the owners appreciate perhaps more fully the dangers and safeguards needed under the conditions. Special precautions, however, should be taken regarding the installation and location of wires and instruments so that these could be burned out without setting fire to the surroundings. Danger to life when handling these telephones should also not be overlooked, but should be guarded against in every way possible, even from the fire standpoint, as accident to the attendant might prevent the prompt cutting off of current in case of trouble on the line.

c. Where such lines must necessarily be carried nearer to other pole lines than is specified in Section *b* above, or where they must necessarily be carried on the same poles with other wires, extra precautions to reduce the liability of a breakdown to a minimum must be taken, such as the use of wires of ample mechanical strength, widely spaced cross-arms, short spans, double or extra heavy cross-arms, extra heavy pins, insulators, and poles thoroughly supported. If carried on the same poles with other wires, the high-pressure wires must be carried at least three feet above the other wires.

This arrangement of circuits should never be adopted unless it is impossible to do otherwise. Where the two lines must be run on the same poles, the importance of heavy substantial line construction as above outlined, cannot be too strongly emphasized.

With the high-pressure wires above the others, there will be far less danger to the wireman who may find it necessary frequently to work on the lower-voltage circuits. This relative location of the transmission line would also be preferable if these wires were larger than the others, as they would be less liable to break.

A separation between the high-pressure and low-pressure wires of say 5 feet would be preferable to that of 3 feet above mentioned, wherever this greater distance can be secured.

d. Where such lines cross other lines, the poles of both lines must be of heavy and substantial construction.

Whenever it is feasible, end-insulator guards should be placed on the cross-arms of the upper line. If the high-pressure wires cross below the other lines, the wires of the upper line should be dead-ended at each end of the span to double-grooved, or to standard transposition insulators, and the line completed by loops.

12A. Constant-Potential Pole Lines, Over 5000 Volts.—Continued.

The object of these end-insulator guards is to prevent the line wire slipping over the end of the cross-arm, in case it becomes loosened from its supports, and falling upon the lower wires. Fig. 20 shows one form of such guard, consisting of a strong wire looped over the live wire and securely fastened to the cross-arm, the corners of which are cut to receive the wire so that it cannot be pulled off from the end of the arm or get out of place and touch the line wire. Another form of guard is shown in Fig. 23, which consists of a flat bar solidly bolted to the frame-work or cross-arm.

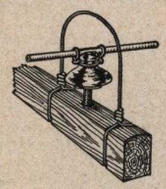


FIG. 20. END INSULATOR GUARD.

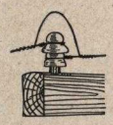


FIG. 21. TRANSPOSITION INSULATOR.

The dimensions and strength of the guards would depend on the existing conditions, such as voltage of circuit, size of line wire, whether on straight runs or at curves, etc. In any case, they should be of such design that they could resist the strain which may be put upon them at time of accident, and the upright bar form of guard should be of such length that the line wire would not be liable to jump over it. This would probably require that the bar extend at least 6 inches above the level of the wires. With the loop form, the radius should generally be at least 4 inches.

Fig. 21 shows a transposition insulator wired as outlined in above rule. In case the wire should break on either side of the cross-over span, this arrangement would prevent the wire from being drawn over the insulator due to the weight of the wire of the cross-over span, which otherwise might occur and result in contact with the high-pressure wires below. The insulator pins should, of course, be sufficiently strong to resist the strain from the cross-over span under the above conditions. The loop connections would generally be made with a McIntyre sleeve or equivalent.

One of the following forms of construction must then be adopted:—

1. The height and length of the cross-over span may be made such that the shortest distance between the lower cross-arms of the upper line and any wire of the lower line will be greater than the length of the cross-over span, so that a wire breaking near one of the upper pins would not be long enough to reach any wire of the lower line. The high-pressure wires should preferably be above the other wires.

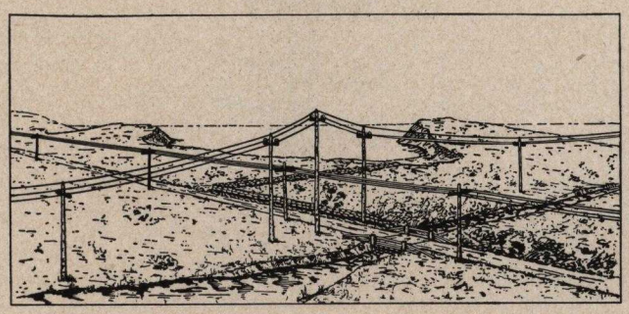


FIG. 22. HIGH PRESSURE LINES CROSSING OTHER LINES.

Fig. 22 illustrates the above method of crossing of high-pressure and low-pressure wires. In the sketch, a high-voltage transmission line crosses a telephone line at a country road. In this case, unless both poles of the cross-over span are set very near the telephone line, the minimum length of the span is limited by the width of the road and the highway regulations and has been taken as 25 feet for this example. Assuming the height of the telephone line to be 20 feet, it is evident that the pole at the end of the cross-over span nearest the telephone line must be of sufficient height to raise the transmissions line at least 45 feet above the ground, in order that none of these upper wires, breaking at a pin on the other pole, can swing and touch the lower wires. The pole on the opposite side of the road is shown somewhat shorter, which of course is permissible and would still prevent contact between the two lines, even though the break should occur at a pin on the taller pole. To avoid any chance of a wire in the span to the left of the cross-over span breaking and whipping back or being blown back against the lower wires, an additional pole has been shown about 25 feet from the tall pole.

Therefore, unless the tall pole should fall or its cross-arm burn or break off, there is practically no chance of contact between the two lines. Such accidents to this pole could be largely avoided by using heavy substantial stock and carefully selected insulators, or by using the iron cross-arms with iron pins thoroughly grounded, or in fact by making the entire pole structure of metal and grounding it. This latter construction would be stronger and probably more durable that the wooden pole, and the grounded metal work would surely prevent the burning off of the arms or pole in case of

12A. Constant-Potential Pole Lines, Over 5000 Volts.—Continued.

broken insulator, etc., as the system would be immediately grounded and the transmission line shut down. The pole, whether of wood or iron, could also be guyed, if thought necessary, in order to secure greater strength. The pole should be carefully inspected sufficiently often to be sure that it is maintained in proper condition.

Care should be taken that the two poles on either side of the tall pole are not so short that when the wires are drawn tight the insulators or tie wires would be subject to an upward tension. Any change in direction of these wires should be gradual, as sharp turns are almost sure to weaken the pole line. This "three-pole" cross-over, as it might be called, would of course be just as applicable where the crossing came in the open country instead of at a road.

A suggestion, somewhat in line with the construction above outlined and already briefly alluded to, has recently been made that the two poles of the cross-over span be set fairly near the lower line, making the span as short as practicable; then in order to protect against an upper wire breaking in either of the adjacent spans, it is suggested that a grounded metal guard be built out from each of the taller poles, just under the upper wires on the side away from the cross-over span, and so proportioned that the wire in falling would strike it before the wire could touch the lower line. By thus grounding the high-tension line, it is expected that a dangerous rise of voltage on the low-potential circuits would be prevented.

Existing conditions in any particular case will largely determine which arrangement is best or in what respects modifications are advisable. The above suggestions, however, are given here, as they all have merit and are believed to be applicable to several different conditions which possibly may be most frequently met in practice.

Where crosses must occur, it is believed that, as a rule, the general style of crossing above outlined is preferable to that using a joint pole or interposed screen.

2. A joint pole may be erected at the crossing point, the high-pressure wires being supported on this pole at least three feet above the other wires. Mechanical guards or supports must then be provided, so that in case of the

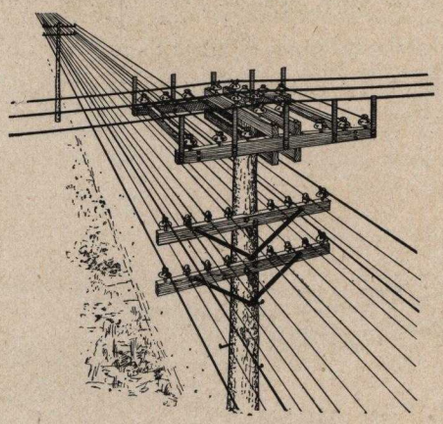


FIG. 23. JOINT POLE CROSSING.

breaking of any upper wire, it will be impossible for it to come into contact with any of the lower wires.

Such liability of contact may be prevented by the use of suspension wires, similar to those employed for suspending aerial telephone cables, which will prevent the high-pressure wires from falling, in case they break. The suspension wires should be supported on high-potential insulators, should have ample mechanical strength, and should be carried over the high-pressure wires for one span on each side of the joint pole, or where suspension wires are not desired guard wires may be carried above and below the lower wires for one span on each side of the joint pole, and so spread that a falling high-pressure wire would be held out of contact with the lower wires.

Such guard wires should be supported on high-potential insulators or should be grounded. When grounded, they must be of such size, and so connected and earthed, that they can surely carry to ground any current which may be delivered by any of the high-pressure wires. Further, the construction must be such that the guard wires will not be destroyed by any arcing at the point of contact likely to occur under the conditions existing.

A suggestion for a joint pole where a high-pressure transmission line crosses several telephone lines is illustrated in Fig. 23. The sketch shows a very strong and substantial wooden framework bolted to the top of a heavy pole and used to support the high-potential insulators for the transmission line and also those for the guard wires. The end insulator guards of flat iron bars are bolted to this framework. The details of construction may be readily seen in the sketch. The telephone wires are shown 5 feet below the transmission line.. The guard wires on the ends of the telephone cross-arms are located about 1 foot from the telephone wires and about 3 inches above them, and are carried one span on each side of the joint pole. These guard wires also are supported on high potential insulators. The upper framework is so laid out that the outerguard wires come directly over the guard wires on the lower cross-arms, so that if any of the high tension wires break they cannot come in contact with the lower wires, for

12A. Constant-Potential Pole Lines, Over 5000 Volts.—Continued.

even if the free end were long enough to ordinarily reach these wires it would, with this arrangement, strike against the guard wire and thus be kept a safe distance from the telephone line. The above rule would require guard wires below the lower wires in addition to those above them, which, of course, can be provided either by means of curved brackets bolted to the side of the lower cross-arm and designed to hold the insulators at the desired level, or an additional cross-arm could be provided below the others on which to support these lower guard wires. With the arrangement shown in the sketch this was not considered necessary to accomplish the desired results, and consequently it was omitted.

The end insulator guards extend about 6 inches above the level of the transmission line and are intended to prevent a broken wire from getting over the side of the framework where it could fall on the wires beneath.

Where it is not desired to insulate the guard wires, as above described, they should be thoroughly grounded. The high-potential insulators would then not be needed, but the precautions given in the rule regarding size of wire, protection against destruction

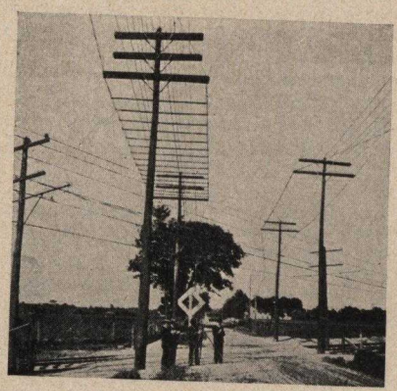


FIG. 24. CROSSING PROTECTED BY SCREEN.

by arcing, excellent ground connections, etc., should be taken. It has been suggested that the entire joint-pole structure be made of steel and effectively grounded. Such a pole could undoubtedly be made stronger than the wooden pole and would probably last longer. All leakage currents from the high-tension line would be carried directly to earth, and in case of a broken high-pressure insulator or wire at this point the line would be definitely grounded and the transmission line probably shut down. There would seem to be practically no chance of sufficient arcing at the pole to destroy it and allow contact between the two lines. The all-metal structure would, therefore, appear preferable to the wooden pole, from the standpoint of the protection of the low-voltage circuits against high-pressure current. However, the danger to linemen working on the low-pressure wires on this pole would be increased and any fault in the insulation of the transmission line at this point would probably mean the immediate shutting down of the plant.

Which construction is best will depend on conditions, and the objection to all of them, outside of the difficulties which may arise from mutual ownership, may lead, in the majority of cases, to the use of the independent form of crossover, previously mentioned, in preference to the joint pole.

3. Whenever neither of the above methods is feasible, a screen of wire should be interposed between the lines at the cross-over. This screen should be supported on high tension insulators, or grounded, and should be of such construction and strength as to prevent the upper wires from coming into contact with the lower ones.

If the screen is grounded each wire of the screen must be of such size and so connected and earthed that it can surely carry to ground any current which may be delivered by any of the high-pressure wires. Further, the construction must be such that the wires of screen will not be destroyed by any arcing at the point of contact likely to occur under the conditions existing.

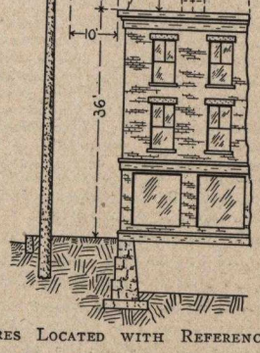


FIG. 25. WIRES LOCATED WITH REFERENCE TO CORNICE.

12A. Constant-Potential Pole Lines, Over 5000 Volts.—Continued.

This method of guarding against accidental contact of the high-tension line with other lines at point of crossing, by means of a screen of wires or "cradle" placed between them, is especially applicable where the high-pressure wires are below the others, for then there is little difficulty in sufficiently insulating the screen to take care of the telephone or low-voltage circuits, or if the screen is grounded there is less liability of destructive arcing when a broken wire falls on to the screen, except possibly where the broken circuit is of very large capacity.

Fig. 24 shows two screens installed under these conditions. Here several signaling circuits cross above an electric railway and transmission line. In this case the grill is made largely of wooden strips instead of wires, but the general results are the same for an insulated screen. The cross-strips are of maple, 1 inch by 2 inches by 12 feet, spaced 12 inches on centres. They are held at the ends by suspension wires fastened to the lower cross-arms. The poles are relieved of any undue strain by extending the suspension wires on both sides of the crossover span and firmly anchoring them to the ground as shown in the case of the screen at the right of the cut. In order to prevent a broken wire sliding off of the screen at the sides, iron strips about ⅜ inch by ¾ inch are fastened to the ends of the wooden strips and project upwards.

If a grounded screen is desired, it should probably be made entirely of wire instead of part wood as in the cut.

e. When it is necessary to carry such lines near buildings, they must be at such height and distance from the buildings as not to interfere with firemen in event of fire; therefore, if within 25 feet of a building, they must be carried at a height not less than that of the front cornice, and the height must be greater than that of the cornice, as the wires come nearer to the building in accordance with the following table:—

Distance of wire from building. Feet	Elevation of wire above cornice of building. Feet.
25	0
20	2
15	4
10	6
5	8
2½	9

It is evident that where the roof of the building continues nearly in line with the walls, as in Mansard roofs, the height and distance of the line must be reckoned from some part of the roof instead of from the cornice.

In order to make the intent of the above rule and its application as clear as possible, the following example is given. Fig. 25 shows in full a three-story building with flat roof and simple cornice overhanging about 2 feet. The poles carrying the high-pressure wires are set just inside the curbing, say, 15 feet from the building. Th cross-arm is 6 feet long, bringing the outside wires say 3 feet each side of the pole. Therefore the wire nearest the building is 10 feet from the cornice, in horizontal projection. Reference to the above table will show that under these conditions the wires must be at least 6 feet above the cornice. If, now, the building had had a very steep pitched roof or especially one of the Mansard type, as shown in dotted lines in this sketch,

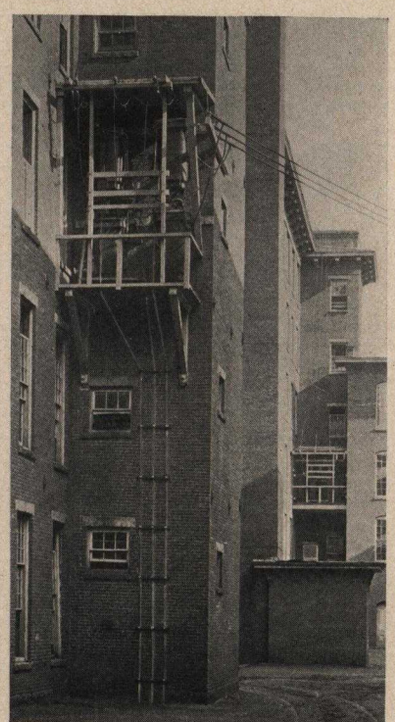


FIG. 26. TRANSFORMERS ON PLATFORMS OUTSIDE BUILDINGS.

13. Transformers—Continued.

it will be readily seen that the above arrangement would not be satisfactory, for the wires would be very liable to interfere with fighting fire in the roof. This is a similar condition to the one referred to in the first fine print note above. Assuming that the

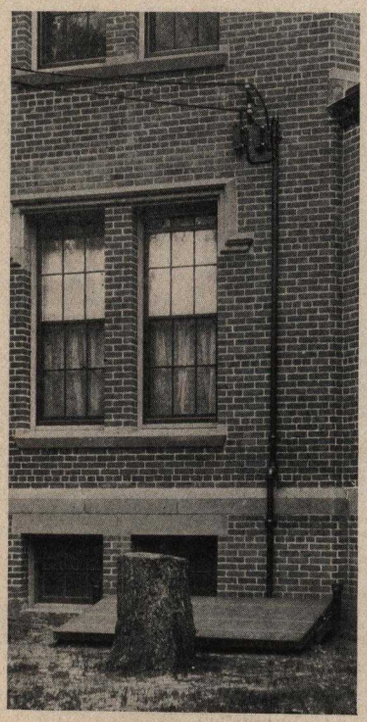


FIG. 27. TRANSFORMER VAULT UNDERGROUND OUTSIDE OF BUILDING.

upper corner of the dotted roof is 5 feet back of the edge of the main cornice, this part of the roof is 15 feet from the nearest wire and consequently the wires must be raised 6 feet above their previous position in order that they may be 4 feet above the roof, as required in the above table when within 15 feet of the building, as in this case. The cut shows very clearly to what extent the dotted Mansard roof affects the height of the pole.

13. Transformers.

(*See also Nos.* 11, 13 *A and* 36.)

Where transformers are to be connected to high voltage circuits, it is necessary in many cases, for best protection to life and property, that the secondary system be permanently grounded, and provision should be made for it when the transformers are built.

a. Must not be placed inside of any building, excepting central stations and sub-stations, unless by special permission of the Inspection Department having jurisdiction.

An outside location is always preferable, first because it keeps the high voltage primary wires entirely out of the building, and second, for the reasons given in the note to No. 11*a*.

It is very rarely necessary to locate transformers inside of buildings, especially in factory work, for there is generally plenty of available space on the outside walls. Wherever possible the transformers should be placed on a blank wall, and when this cannot be done, it is advised that the windows in the vicinity of them be made of wire glass, with tinned sashes. Under these conditions a severe fire about the transformers would probably not seriously endanger the building before it could be extinguished.

The transformer station shown in the foreground of Fig. 26 consists of four transformers with a capacity of 25 K. W. each. The roof was found necessary, at this particular mill, to protect the apparatus from ice and snow falling from above, and the platform was provided for the convenience and safety of the electrician in making repairs and changes. As a general rule, however, as little combustible material as possible should be used around the transformers. The three wires running down the wall are the ground wires from the three lightning arresters, which are mounted on the horizontal cross-bars in front of the transformers. These wires should usually be protected by heavy wooden boxing entending 7 or 8 feet above the ground and firmly secured to the wall. The ground connection at this plant is made with a copper plate.

The station visible in the background of Fig. 26 is in every way similar to the one in the foreground.

Fig. 28 shows a single transformer bolted to two heavy wooden cleats on the outside wall of a brick building, and placed as far away as possible from the surrounding windows. This arrangement fulfills the requirements of 13b with the least possible amount of combustible material, and is heartily recommended. The two primary fuse boxes are located on the upper cleat, and the primary wires run nearly at right angles to the wall from a pole set well away from the building.

Where it is impracticable or undesirable to locate transformers on the outside wall of a building, it may be feasible to place them

13. Transformers—Continued

in an underground vault just outside the foundation wall, as shown in Fig. 27. At this plant, the primary wires are brought to fuse boxes on the wall, and lead-covered cable is carried thence in iron pipe down into the vault. The cover is removable, and is made of wood tinned on both sides like a standard fire-door. Good ventilation is obtained by the two iron pipes shown at the ends, one pipe extending nearly to the bottom of the vault, and the other just inside the top. The other requirements of Rule 36, have also been well carried out in this enclosure.

The secondary wires enter the building through iron pipes cemented into the wall, and the spaces between the wires and the pipes are filled up by cement, the wires being lead-covered.

This is an excellent arrangement, as all high voltage wires are kept out of the building and there is absolutely no opening between the vault and the building through which smoke or fire could pass.

FIG. 28 TRANSFORMER ON OUTSIDE WALL.

b. Must not be attached to the outside walls of buildings, unless separated there-from by substantial supports.

It is recommended that transformers be not attached to frame buildings when any other location is practicable.

The intent of this rule is to provide an air-space between the transformer and the wall. If the transformer is in direct contact with the wall, a leakage current at this point might do considerable damage by electrolysis or charring before it was discovered. Two heavy wooden cross-bars, as shown in Fig. 30, are considered sufficient for this purpose.

13A. Grounding Low-Potential Circuits.

The grounding of low-potential circuits under the following regulations is only allowed when such circuits are so arranged that under normal conditions of service there will be no passage of current over the ground wire.

Direct-Current 3-Wire Systems.

a. Neutral wire may be grounded and when grounded the following rules must be complied with:—

1. Must be grounded at the Central Station on a metal plate buried in coke beneath permanent moisture level, and also through all available underground water and gas pipe systems.
2. In underground systems the neutral wire must also be grounded at each distributing box through the box.
3. In overhead systems the neutral wire must be grounded every 500 feet, as provided in Sections *c* to *g*.

Inspection Departments having jurisdiction may *require* grounding if they deem it necessary.

Two-wire direct-current systems having no accessible neutral point are not to be grounded.

If the neutral is to be grounded at all, it should be done as thoroughly as possible, lest the current escape to the ground at points where the resistance is sufficient to cause unsafe heating.

A good ground connection may be made through any main water pipe that is thoroughly connected to underground pipes. The wire should be securely attached to the pipe by soldering it to a brass plug screwed into a fitting, or by binding it under a heavy split clamp, or by any other equally thorough method.

Alternating-Current Secondary Systems.

b. Transformer secondaries of distributing systems should preferably be grounded, and when grounded, the following rules must be complied with:—

1. The grounding must be made at the neutral point or wire, whenever a netural point or wire is accessible.
2. When no neutral point or wire is accessible one side of the secondary circuit may be grounded, provided the maximum difference of potential between the grounded point and any other point in the circuit does not exceed 250 volts.
3. The ground connection must be at the transformer or on the individual service as provided in section *c* to *g*, and when transformers feed systems with a neutral wire, the neutral wire must also be grounded at least every 250 feet for overhead systems, and every 500 feet for underground systems.

Inspection Departments having jurisdiction may *require* grounding if they deem it necessary.

If the primary and secondary coils of a transformer come into contact electrically, the high-voltage primary current may flow to the secondary system. If this should happen, the life of any one handling any part of the secondary system would be endangered,

13A. Grounding Low Potential Circuits—Continued.

and fires would probably be started by arcs caused by breaking down of the insulation of the wires or fittings on the secondary system. If however, the secondary coil is grounded, a breakdown in the transformer cannot cause a dangerous difference of potential between the secondary system and the ground, and only with certain unusual combinations of contacts between the primary and secondary wires outside of the transformers, will this protection fail to prevent the voltage of the secondary system from being raised above its normal limit. In order to secure the full benefit of the ground connection, reliable primary fuses of proper carrying capacity must be provided.

The middle of the secondary coil is the proper point to ground, as there is then only half the normal secondary voltage between either side and the ground, thus reducing the liability of a breakdown of insulation and also materially lessening the danger of fire if a breakdown does occur.

There is an objection to grounding the secondary on the other hand, for when this is done, the first breakdown of insulation may mean a short-circuit and a possible fire. With a system free from grounds, a breakdown must exist on each side of the system to cause a short-circuit, and with proper ground detectors the first can generally be discovered and remedied before the second occurs.

Grounding is therefore a choice of evils, but in many cases it is believed to be a lesser one than to risk getting the primary current on the secondary system. This is especially true where the primary voltage is high, say 3500 or over. For this reason it is advised that all transformers be so designed and connected that the middle point of the secondary coil can be reached if, at any future time, it should be desired to ground it.

After the transformer secondary has been properly grounded a test should be made, especially if the transformer is some distance from the building supplied, in order to determine if the protection expected from the ground connection at the transformer is really effective inside the building in question, and if not the connection should be extended to accomplish the desired result. Cases have been known where the effectiveness of a ground connection has been limited to a comparatively small area, due to the exact conditions of the earth in the neighborhood of the ground plate and between it and the point where the protection due to the grounding was desired. The entire ground connection should be carefully examined at least once a year.

Ground Connections.

c. When the ground connection is inside of any building, or the ground wire is inside of, or attached to any building (except Central or Sub-stations) the ground wire must be of copper and have an approved rubber insulating covering National Electrical Code Standard, for from 0 to 600 volts. (See No. 41.)

d. The ground wire in direct-current 3-wire systems must not at Central Stations be smaller than the neutral wire and not smaller than No. 4 B. & S. gage elsewhere. The ground wire in alternating current systems must never be less than No. 4 B. & S. gage.

On three-phase systems, the ground wire must have a carrying capacity equal to that of any of the three mains.

These requirements for the size of the ground wire are intended to prevent the burning off of this connection, as well as to insure that it has sufficient mechanical strength to prevent its being easily broken. This end is accomplished by making the carrying capacity of the ground wire equal to the combined capacities of all the wires for which, under any conditions, it may become the return wire.

e. The ground wire should, except for Central Stations and transformer sub-stations, be kept outside of buildings as far as practicable, but may be directly attached to the buildings or pole by cleats or straps or on porcelain knobs. Staples must never be used. The wire must be carried in as nearly a straight line as practicable, avoiding kinks, coils and sharp bends, and must be protected when exposed to mechanical injury.

This protection can be secured by use of an approved moulding, and as a rule the ground wire on the outside of the building should be in moulding at all places where it is within seven feet from the ground.

Kinks, coils, etc., are objectionable, as they impede the flow of an alternating current or a lightning discharge.

f. The ground connection for Central Stations, transformer sub-stations, and banks of transformers must be made through metal plates buried in coke below permanent moisture level, and connection should also be made to all available underground piping systems including the lead sheath of underground cables.

g. For individual transformers and building services, the ground connection may be made as in Section *f*, or may be made to water piping systems running into buildings. This connection may be made by carrying the ground wire into the cellar and connecting on the street side of meters, main cocks, etc.

Where it is necessary to run the ground wire through any part of a building it shall be protected by approved porcelain bushings through walls or partitions and shall

13A. Grounding Low Potential Circuits—Continued.

be run in approved moulding, except that in basements it may be supported on porcelain.

In connecting a ground wire to a piping system, the wire should be sweated into a lug attached to an approved clamp, and the clamp firmly bolted to the water pipe after all rust and scale have been removed; or be soldered into a brass plug and the plug forcibly screwed into a pipe-fitting, or, where the pipes are cast iron, into a hole tapped into the pipe itself. For large stations, where connecting to underground pipes with bell and spigot joints, it is well to connect to several lengths, and the pipe joints may be of rather high resistance.

Where ground plates are used, a No. 16 Stubbs' gage copper plate, about three by six feet in size, with about two feet of crushed coke or charcoal, about pea size, both under and over it, would make a ground of sufficient capacity for a moderate-sized station, and would probably answer for the ordinary sub-station or bank of transformers. For a large central station a plate with considerably more area might be necessary, depending upon the other underground connections available. The ground wire should be riveted to the plate in a number of places, and soldered for its whole length. Perhaps even better than a copper plate is a cast-iron plate with projecting forks, the idea of the fork being to distribute the connection to the ground over a fairly broad area, and to give a large surface contact. The ground wire can probably best be connected to such a cast-iron plate by soldering it into brass plugs screwed into holes tapped in the plate. In all cases, the joint between the plate and the ground wire should be thoroughly protected against corrosion by painting it with waterproof paint or some equivalent.

In addition to connecting the ground wire to the street side of meters, etc., as above required, it should be connected to the piping on the other side of them also, in order to be sure that protection is still effective in case these appliances should be removed.

CLASS C.
INSIDE WORK.

(Light, Power and Heat. For Signaling Systems see Class E.)

ALL SYSTEMS AND VOLTAGES.

14. Wires.

(For special rules, see Nos. 16, 18, 24, 35, 38 and 39.)

a. Must not be of smaller size than No. 14 B .& S. gage, except as allowed under Nos. 24 *v* and 45 *b*.

It has been found by experience that wires smaller than the sizes specified are not mechanically strong enough to be safely used.

b. Tie wires must have an insulation equal to that of the conductors they confine.

The use of some form of confining knob or insulator which will dispense with tie wires is recommended.

c. Must be so spliced or joined as to be both mechanically and electrically secure without solder. The joints must then be soldered to insure preservation, and covered with an insulation equal to that on the conductors.

Stranded wires must be soldered before being fastened under clamps or binding screws, and whether stranded or solid, when they have a conductivity greater than that of No. 8 B. & S. gage they must be soldered into lugs for all terminal connections.

All joints must be soldered unless made with some form of *approved* splicing device. This ruling applies to joints and splices in all classes of wiring covered by these rules.

Connections by clamps, screws, etc., are not reliable where stranded wire is used. It is generally impossible to thoroughly connect all of the strands by such a method, and consequently the whole current has to be carried by a part of them, which is likely to result in their becoming dangerously hot.

See also note under Rule 12 f.

d. Must be separated from contact with walls, floors, timbers or partitions through which they may pass by non-combustible, non-absorptive insulating tubes, such as glass or porcelain, except as provided in No. 24 *u*.

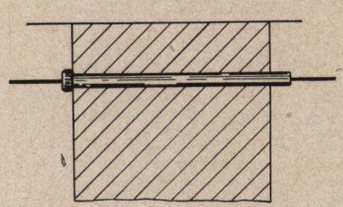


FIG. 29. CONTINUOUS BUSHING THROUGH PARTITION.

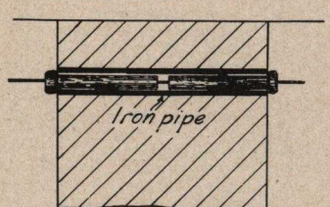


FIG. 30. BUSHING FOR THICK WALL.

Bushings must be long enough to bush the entire length of the hole in one continuous piece, or else the hole must first be bushed by a continuous waterproof tube. This tube may be a conductor, such as iron pipe, but in that case an insulating bushing must be pushed into each end of it, extending far enough to keep the wire absolutely out of contact with the pipe.

An insulating tube or bushing should be continuous, and of sufficient length to extend beyond the face of the wall at least ¼ inch. See Fig. 29. On the other hand, it should not extend so far out as to make it liable to be broken by the strain on the wire or by the ordinary brushing down of the rooms.

Broken bushings should not be used, as the sharp edges will injure the insulation. Even where attempts have been made to smooth these edges, the conditions have generally been improved but little, if any. The presence of broken tubes is considered as evidence of poor workmanship.

With a very thick wall, a single tube of sufficient length may not be readily obtainable, in which case the arrangement shown in Fig. 30 can be used. The iron pipe furnishes a continuous waterproof tube, and the bushings serve to insulate the wire and provide a smooth passage for it.

14. Wires—Continued.

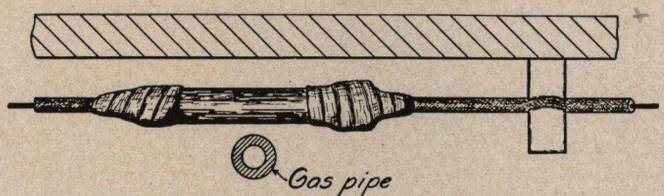


FIG. 31. WIRE CROSSING PIPE PROTECTED BY A PORCELAIN TUBE.

Where the wall is unusually thick, it is possible that two bushings would not be long enough to bush the entire length of the pipe. Under these conditions, the arrangement shown in Fig. 30 could still be used by inserting between the bushings a piece of lined conduit or flexible insulating tubing to project the wire in this central space.

In all cases, the bushings should be firmly fastened in place, and the rough holes made in the wall for the tubes should be cemented up as soon as the latter is securely in place. See Fig. 31.

e. Must be kept free from contact with gas, water or other metallic piping, or any other conductors or conducting material which they may cross, by some continuous and firmly fixed non-conductor, creating a permanent separation. Deviations from this rule may sometimes be allowed by special permission.

Where one wire crosses another wire the best and usual means of separating them is by a porcelain tube on one of the wires. The tubing must be prevented from moving out of place either by a cleat or knob on each end, or by taping it securely in place. (See Fig. 31.)

The same method may be adopted where wires pass close to iron pipes, beams, etc., or where the wires are above the pipes, as is generally the case. Ample protection can frequently be secured by supporting the wires with a porcelain cleat placed as nearly above the pipe as possible.

This rule must not be construed as in any way modifying No. 24, Sections h and j.

Both of the methods described above are well illustrated in Fig. 33, which also shows the following additonal good points:

1. The mains from timber to timber are very tight and well supported. By means of turn-buckles used with strain insulators, in the manner shown in Fig. 32, these wires may be kept taut.

2. Where the wires are wrapped around the timbers, the cleats on the ceiling are set off from the timbers about 3 or 4 inches, which is believed to be the best arrangement. Where these cleats are crowded into the corner, the vertical wires soon come in contact with the side of the timber, as a result of the inevitable slackening of the wires, caused by the shrinking of the wood as well as the rough usage received in "Sweeping-down," which in many places has to be done very often. On the other hand, if the distance between the cleat and the timber is made greater, say 12 or even 18 inches, as has sometimes been done, the wires are too much exposed to the knocks of brooms, ladders, etc., and soon become deranged. With this arrangement any slack wire can later be readily taken up by moving the cleats nearer the corner, without disturbing the rest of the wiring.

3. The wires are protected in iron pipes the entire distance from floor to ceiling.

4. There is a general order and neatness evident throughout, indicating careful planning and good workmanship.

f. Must be so placed in wet places that an air space will be left between conductors and pipes in crossing, and

14. Wires—Continued.

the former must be run in such a way that they cannot come in contact with the pipe accidentally. Wires should be run over, rather than under pipes upon which moisture

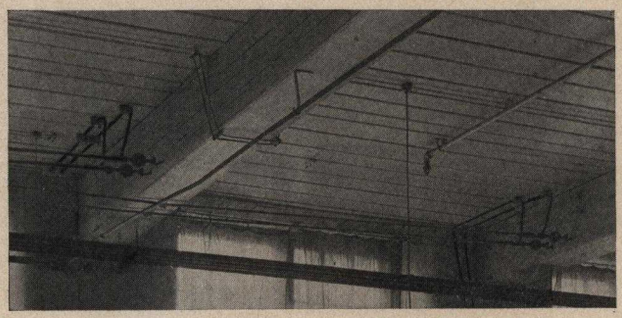


FIG. 32. OVERHEAD WIRING SHOWING USE OF STRAIN INSULATORS.

is likely to gather or which, by leaking, might cause trouble on a circuit.

If the wires are below the pipes, water may drip down upon them and run along to and over the insulators, thus forming between the wires and the building a connection which would be liable, in time, to cause a short-circuit or a dangerous ground.

g. The installation of electrical conductors in wooden moulding, or on insulators, in elevator shafts will not be approved, but conductors may be installed in such shafts if encased in approved metal conduits.

15. Underground Conductors.

a. Must be protected against moisture and mechanical injury where brought into a building, and all combustible material must be kept from the immediate vicinity.

There being often no safety fuses for such underground wires, a contact between wires, or between the wires and the ground, would result in serious arcing and perhaps in even melting off the wires.

b. Must not be so arranged as to shunt the current through a building around any catch-box.

c. Where underground service enters building through tubes, the tubes shall be tightly closed at outlets with asphaltum or other non-conductor to prevent gases from entering the building through such channels.

d. No underground service from a subway to a building shall supply more than one building except by written permission from the Inspection Department having jurisdiction.

16. Table of Carrying Capacity of Wires.

a. The following table, showing the allowable carrying capacity of copper wires and cables of ninety-eight per cent conductivity, according to the standard adopted by the American Institute of Electrical Engineers, must be followed in placing interior conductors.

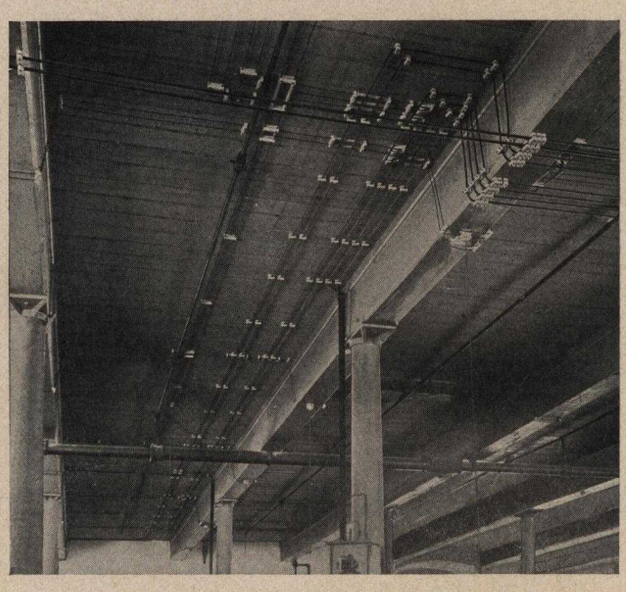


FIG. 33. EXAMPLE OF GOOD OVERHEAD WIRING.

16. Table of Carrying Capacity of Wires—Continued.

For insulated aluminum wire the safe carrying capacity is eighty-four per cent of that given in the following tables for copper wire with the same kind of insulation.

B & S. G.	TABLE A. Rubber Insulation. See No. 41. Amperes	TABLE B. Other Insulations. See Nos. 42 to44. Amperes.	Circular Mils.
18	3	5	1,624
16	6	8	2,583
14	12	16	4,107
12	17	23	6,530
10	24	32	10,380
8	33	46	16,510
6	46	65	26,250
5	54	77	33,100
4	65	92	41,740
3	76	110	52,630
2	90	131	66,370
1	107	156	83,690
0	127	185	105,500
00	150	220	133,100
000	177	262	167,800
0000	210	312	211,600
Circular Mils.			
200,000	200	300	
300,000	270	400	
400,000	330	500	
500,000	390	590	
600,000	450	680	
700,000	500	760	
800,000	550	840	
900,000	600	920	
1,000,000	650	1,000	
1,100,000	690	1,080	
1,200,000	730	1,150	
1,300,000	770	1,220	
1,400,000	810	1,290	
1,500,000	850	1,360	
1,600,000	890	1,430	
1,700,000	930	1,490	
1,800,000	970	1,550	
1,900,000	1,010	1,610	
2,000,000	1,050	1,670	

The lower limit is specified for rubber-covered wires to prevent gradual deterioration of the high insulations by the heat of the wires, but, not from fear of igniting the insulation. The question of drop is not taken into consideration in the above tables.

The carrying capacity of Nos. 16 and 18, B. & S. gage wire is given, but no smaller than No. 14 is to be used, except as allowed under Nos. 24 *v* and 45 *b*.

There is a general agreement among those familiar with the effect of heat or rubber, that, if long life is desired, the temperature should not exceed 150° F.

In 1889, Mr. A. E. Kennelly made an elaborate series of careful experiments at the Edison Laboratory, to determine the temperature rise caused in wires under different conditions by currents of various strengths.

The currents given in Table A are about 60% of the currents which Mr. Kennelly found caused a rise of 75° F., or a final temperature of about 150° F., assuming 75° F. as the average indoor temperature. This margin of 40% is to allow for inevitable increase of current, such as that produced by the changing from one size lamp to those of a larger candlepower, the adding of more lamps to a circuit, the overloading of a motor, etc. The currents given in Table A cause a rise of temperature of about 29° F. above the surroundings, but varying somewhat with the size of the wire. It is well to remember in this connection that the heating effect increases about as the square of the current,—i. e., if the current is doubled, for instance, the heating effect increases four times.

The limiting temperature for weatherproof insulation is about the same as for rubber, but a smaller factor of safety is allowable, as the covering on this class of wire is not greatly depended on for insulation, the insulation of the system being secured by the porcelain or glass supports to which the wire is attached. The currents in Table B, therefore, were obtained by taking 90% of the currents which Mr. Kennelly found caused the wire to reach a temperature of 150° F., when the surrounding air was at 75° F. This allows a margin of only 10% instead of the 40% considered necessary in Table A.

It is interesting to note that, for any given size of wire, a current about three times as great as that given in Table A causes all ordinary insulations to begin to smoke.

Owing to the cooling effect of air currents, the safe carrying capacity of outdoor conductors may be several times greater than the above, without causing any dangerous rise of temperature. As the conditions will vary so widely, and as such outdoor conductors are not at all liable to cause fire, no table has been made for them.

17. Switches, Cut-outs, Circuit-Breakers, Etc.

a. On constant potential circuits, all service switches and all switches controlling circuits supplying current to motors or heating devices, and all cut-outs unless otherwise provided (for exceptions as to switches see Nos. 8 *c* and 21 *a;* for exceptions as to cut-outs see No. 21 *a* and *b*) must be so arranged that the cut-outs will protect and the opening of the switch or circuit-breaker will disconnect all of the wires; that is, in the two-wire system the two wires, and the three-wire system the three wires, must be protected by the cut-out and disconnected by the operation

17. Switches, Cut-outs, Circuit-Breakers, etc.—Continued

of the switch or circuit-breaker.

This, of course, does not apply to the grounded circuit of street railway systems.

b. Must not be placed in the immediate vicinity of easily ignitible stuff or where exposed to inflammable gases or dust or to flyings of combustible material.

When the occupancy of a building is such that switches, cut-outs, etc., cannot be located so as not to be exposed to dust or flyings of combustible material they must be enclosed in approved dust-proof cabinets with self-closing doors, except oil switches and circuit breakers which have dust-tight casings.

An arc is always formed when a switch is opened while carrying current, the intensity and duration depending on the strength of the current, the design and condition of the switch and the speed with which it is operated. Combustible dust, lint or flyings are liable to be ignited by such an arc, and hence the switch should be so located or enclosed that they cannot accumulate around it. Under certain conditions, it may be necessary to so arrange the switch that it can be operated from the outside, without having to open the enclosing cabinet, as shown in Fig. 9.

Air-brake circuit-breakers and link fuses, if operated by a sudden heavy overload or a short-circuit on the system, make a considerable flash and often throw out hot metal, bits of hot carbon, etc., so that it is important to isolate them from all readily inflammable material.

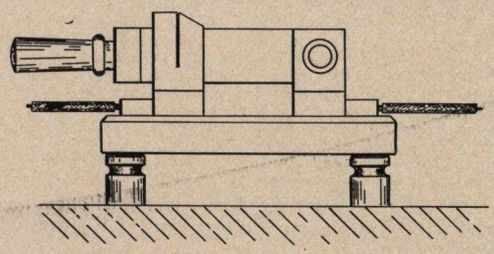


FIG. 34. KNIFE SWITCH MOUNTED ON PORCELAIN KNOBS.

c. Must, when exposed to dampness, either be enclosed in a moisture-proof box or mounted on porcelain knobs. See Fig. 34.

The cover of the box should be so made that no moisture which may collect on the top or sides of the box can enter it.

For the reasons given in the note under Rule 3 d.

d. Time switches, sign flashers and similar appliances must be of approved design and enclosed in a steel box or cabinet lined with fire-resisting material.

If a steel box is used, the minimum thickness of the steel must be 0.128 of an inch (No. 8 B. & S. gage).

If a cabinet is used, it must be lined with marble or slate at least three-eighths of an inch thick, or with steel not less than 0.128 of an inch thick. Box or cabinet must be so constructed that when switch operates blade shall clear the door by at least one inch.

These switches, being automatic, are liable to fail, especially the cheaper grades, in which case severe arcing may result. The enclosing of the switches is therefore necessary in order to prevent as far as possible igniting surrounding combustible material,

17. Switches, Cut-outs, Circuit Breakers, etc.—Continued.

should such failure occur. The 1 inch clearance between the cabinet, when closed, and any moving part of the switch in any position is, first, to merely prevent the cabinet interfering with free movement of the entire mechanism; and second, to guard against short-circuit due to contact of live parts with the cabinet, in case it is made of iron or is iron lined.

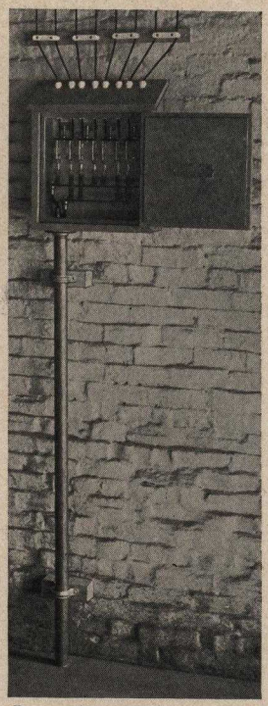


FIG. 35. SLATE LINED CABINET WITH KNIFE SWITCHES AND OPEN LINK FUSES.

Fig. 35, as well as Fig. 45, are excellent examples of thoroughly good cabinets of simple construction.

In all these illustrations, attention is called to the slanting top, which prevents the accumulation of dust upon it and keeps it from being used as a shelf. This is a very desirable feature. The bushings should be of such a length that they will reach just inside the cabinet, as longer ones are likely to become broken, and shorter ones do not afford sufficient protection.

Fig. 44 shows a wooden box lined with slate throughout, including the inside of the door, and containing link fuses and knife switches mounted on the slate back The bus-bars are carefully taped and then painted with a black enamel paint, presenting a very neat appearance and greatly reducing the amount of bare live metal. The pipe which protects the feed wires is fastened to the bottom of the box by an ordinary pipe flange, and each wire is separately encased in flexible insulating tubing.

CONSTANT CURRENT SYSTEMS.
Principally Series Arc Lighting.

18. Wires.

(*See also Rules 14, 15 and 16.*)

a. Must have an *approved* rubber insulating covering (See No. 41.)

The high voltages generally employed with these systems make it desirable to have the very best insulation.

b. Must be arranged to enter and leave the building through an *approved* double-contact service switch, mounted in a non-combustible case, kept free from moisture, and easy of access to police or firemen.

This is to make it possible to cut the high-voltage current entirely out of a building in case of fire. The switch is also necessary when work is to be done on the inside wires.

By "double-contact" switch is meant a switch which first short-circuits the loop which it controls, and then cuts it off, thus avoiding any break in the main circuit. In a constant-current system, the voltage at the terminals of the generator increases in direct proportion as the resistance of the circuit is increased, and the maximum is usually several thousand volts. If the circuit is broken at any point, this maximum voltage is available to maintain a very severe arc across the break, and this must be carefully guarded against, as such an arc is very destructive.

c. Must always be in plain sight, and never encased, except when *required* by the Inspection Department having jurisdiction.

High voltage wires should always be located where they can be under constant inspection.

18. Wires—Continued.

d. Must be supported on glass or porcelain insulators, which separate the wire at least one inch from the surface wired over and must be kept *rigidly* at least eight inches from each other, except within the structure of lamps, on hangerboards or in cut-out boxes, or like places, where a less distance is necessary.

It is especially important with these high-voltage wires to secure perfect insulation of the system. Hence the required distance from the surface wired over and between the wires themselves is greater than that for low-voltage systems.

e. Must, on side walls be protected from mechanical injury by a substantial boxing, retaining an air space of one inch around the conductors, closed at the top (the wires passing through bushed holes), and extending not less than seven feet from the floor. When crossing floor timbers in cellars, or in rooms where they might be exposed to injury, wires must be attached by their insulating supports to the under side of a wooden strip not less than one-half an inch in thickness. Instead of the running-boards, guard strips on each side of and close to the wires will be accepted. These strips must not be less than seven-eights of an inch in thickness and at least as high as the insulators.

18.—Wires—Continued.

Except on joisted ceilings, a strip one-half of an inch thick is not considered sufficiently stiff and strong. For spans of say eight or ten feet, where there is but little vibration, one-inch stock is generally sufficiently stiff; but where the span is longer than this or there is considerable vibration, still heavier stock should be used.

19. Series Arc Lamps.

a. Must be carefully isolated from inflammable material.

b. Must be provided at all times with a glass globe surrounding the arc, and securely fastened upon a closed base. Broken or cracked globes must not be used.

"Open arc" lamps are always liable to throw off sparks, hot bits of carbon or even the entire red-hot carbon itself. The globe is intended to prevent the escape of such hot particles and to shield the arc from air drafts, knocks, etc.

With "enclosed arc" lamps, a tight globe about the arc is always provided, as this is necessary for the proper operation of the lamp.

c. Must be provided with a wire netting (having a mesh not exceeding one and one-fourth inches) around the globe, and an *approved* spark arrester, when readily inflammable material is in the vicinity of the lamps, to prevent escape of sparks of carbon or melted copper. It is recommended that plain carbons, not copper-plated, be used for lamps in such places.

Outside arc lamps must be suspended at least eight feet above sidewalks. Inside arc lamps must be placed out of reach or suitably protected.

Arc lamps, when used in places where they are exposed to flyings of easily inflammable material, should have the carbons enclosed completely in a tight globe in such manner as to avoid the necessity for spark arresters.

"Enclosed arc" lamps, having tight inner globes, may be used, and the requirements of Section *b* and *c* above would, of course, not apply to them, except that a wire netting around the inner globe may in some cases be required if the outer globe is omitted.

d. Where hanger-boards are not used, lamps must be hung from insulating supports other than their conductors.

The weight of the lamp, especially where the floors are subject to vibration, is liable to loosen the connections between the lamp and the conductors if they are used for supports. This would result in more or less arcing at the loose connection, which might in time melt off the wire and thus cause a break in the circuit. The serious consequences of such a break in a constant-current circuit are briefly referred to in the note to Rule 18 b

19. Series Arc Lamps—Continued.

In order to still further lessen the chances of loose connections, it is advised that the wires be soldered into all binding posts, etc., also that, as far as practicable, the leads to the lamps be stranded instead of solid, in order to minimize the chance of breakage of these conductors due to swinging of lamp or other vibrations.

e. Lamps when arranged to be raised and lowered, either for carboning or other purposes, shall be connected up with standard conductors from the last point of support to the lamp, when such conductor is larger than No. 14 B. & S. gage.

20. Incandescent Lamps in Series Circuits.

a. Must have conductors installed as required in No. 18, and each lamp must be provided with an automatic cut-out.

The object of such cut-out is to automatically shunt the current around the lamp in case the circuit becomes broken, due to lamp jarring loose, lamp filament breaking, etc.; otherwise a destructive arc might be drawn under these conditions. (See note under Rule 18b.)

b. Must have each lamp suspended from a hanger-board by means of rigid tube.

This form of construction removes all strain from the binding screws which hold the wire in place in the socket, besides preventing the wires from coming into contact with surrounding objcts, or from being broken by the constant handling and bending to which the ordinary cord pendant is subjected.

The voltage across a break anywhere in a series system is sure to be very high and to cause severe arcing, as explained in the note to Rule 18b, and unusual precautions are therefore necessary.

c. No electro-magnetic device for switches and no multiple-series or series-multiple system of lighting will be approved.

Experience has shown that magnetic devices become rusty or filled with dust, and often fail when wanted.

Both multiple-series and series-multiple systems of lighting were once used, but gave a good deal of trouble and proved themselves generally unreliable.

d. Must not under any circumstances be attached to gas fixtures.

It would be especially dangerous to attach these high-voltage wires to metal pipes so thoroughly connected with the ground, especially as an arc at this point might perforate the pipe and ignite the gas.

CONSTANT POTENTIAL SYSTEMS.

GENERAL RULES—ALL VOLTAGES.

21. Automatic Cut-outs (Fuses and Circuit-Breakers).

(*See No. 17.*)

Excepting on main switchboards, or where otherwise subject to expert supervision, circuit-breakers will not be accepted unless fuses are also provided.

a. Must be placed on all service wires, either overhead or underground, as near as possible to the point where they enter the building and inside the walls, and arranged to cut off the entire current from the building.

Where the switch required by No 22 *a* is inside the building, the cut-out required by this section must be placed so as to protect it.

For three-wire (not three-phase) systems the fuse in the neutral wire may be omitted, *provided the neutral wire is of equal carrying capacity to the larger of the outside wires, and is grounded as provided for in No. 13A.*

In risks having private plants, the yard wires running from building to building are not generally considered as service wires, so that cut-outs would not be required where the wires enter buildings, provided that the next fuse back is small enough to properly protect the wires inside the building in question.

The purpose of such cut-outs is to make sure that the wires inside a building cannot be subjected to a current larger than they can safely carry. They are absolutely necessary when taking current from a public plant, as the fuses in the mains are often changed without regard to the size of the wires in the buildings.

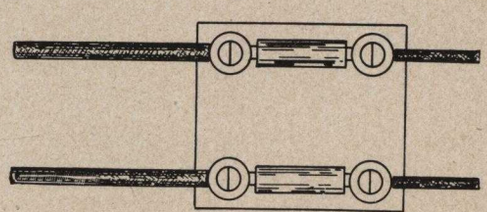


FIG. 36. CUT-OUT AT POINT WHERE CHANGE IS MADE IN SIZE OF WIRES.

21. Automatic Cutouts—Continued.

b. Must be placed at every point where a change is made in the size of wire [unless the cut-out in the larger wire will protect the smaller (see No. 16)].

For three-wire (not three-phase) systems the fuse in the neutral wire except that called for under No. 21 *d*, may be omitted, *provided the neutral wire is of equal carrying capacity to the larger of the outside wires, and is grounded as provided for in No. 13A.*

It will frequently be found necessary to provide cut-outs where taps are taken from large mains. In such cases, if the clamps on the cut-outs are not sufficiently large and strong to give a firm and secure connection, a short length of smaller wire may be soldered to the main wire and then carried direct to the cut-out, which should be located as near as possible to the point of connection with the mains. Special care should be taken to guard these leads from accident as they may not be properly protected by the fuses in the main circuit.

c. Must be in plain sight, or enclosed in an *approved* cabinet and readily accessible. They must not be placed in the canopies or shells of fixtures.

The ordinary porcelain link fuse cut-out will not be approved. Link fuses may be used only when mounted on slate or marble bases conforming to No. 52 and must be enclosed in dust-tight fireproofed cabinets except on switchbards located well away from combustible material, as in the ordinary engine and dynamo room and where these conditions will be maintained.

In such places as picker and carding rooms, cloth napping and shearing rooms, wood-working shops, etc., where inflammable dust or flyings are liable to accumulate about the fuses, cabinets should be provided in all cases, even with fuses of the enclosed type. See illustration and description of good cabinet under Rule 17.

d. Must be so placed that no set of incandescent lamps requiring more than 660 watts, whether grouped on one fixture or on several fixtures or pendants, will be dependent upon one cut-out.

Special permission may be given in writing by the Inspection Department having jurisdiction, for departure

21. Automatic Cut-outs—Continued.

from this rule, in the case of large chandeliers. (For exceptions, see No. 31 A.*b*, 3 [*b*] & 4 [*b*] for border lights, see List of Fittings for rules for electric signs.) All branches or taps from any three-wire system which are directly connected to lamp sockets or other translating devices, must be run as two-wire circuits if the fuses are omitted in the neutral, or if the difference of potential between the two outside wires is over 250 volts, and both wires of such branch or tap circuits must be protected by proper fuses.

The above rule shall also apply to motors when more than one is dependent on a single cut-out.

The fuses in the branch cut-outs should not have a rated capacity greater than 6 amperes on 110 volt systems, and 3 amperes on 220 volt systems.

The idea is to have a small fuse to protect the lamp socket and the small wire used for fixtures, pendants, etc. It also lessens the chances of extinguishing a large number of lights if a short circuit occurs.

On open work in large mills *approved* link fused rosettes may be used at a voltage of not over 125 and *approved* enclosed fused rosettes at a voltage of not over 250, the fuse in the rosettes not to exceed 3 amperes, and a fuse of over 25 amperes must not be used in the branch circuit.

e. The rated capacity of fuses must not exceed the allowable carrying capacity of the wire as given in No. 16. Circuit-breakers must not be set more than 30 per cent above the allowable carrying capacity of the wire, unless a fusible cut-out is also installed in the circuit.

In the arms of fixtures carrying a single socket a No. 18 B. & S. gage wire supplying only one socket will be considered as properly protected by a six ampere fuse.

Specifications for fuses require that they shall be rated at a certain per cent of the maximum current which they will carry indefinitely, as follows: link fuses 80% and enclosed fuses 90%. The margin thus provided between the rating of the fuse and its actual melting point will permit the ordinary fluctuations in current without opening the circuit. If fuses selected to conform to the above rule are not large enough to carry the load, it is evident that the wires also are overloaded, and either the load should be diminished or the size of the wire increased.

Circuit-breakers are so sensitive that it is often necessary to set them much above the ordinary current to keep them from being constantly opened by momentary rises in the current, such as might be caused by starting a motor or by a rise in the voltage of the dynamo due to a sudden decrease of load. When this is the case, a fuse may be necessary to protect the wire from a steady current above the safe carrying capacity of the wire but below the point at which the circuit-breaker is set to open. The fuse requires a little time to heat, and so does not melt with the momentary rises of current which would open the curcuit-breaker if it were set as low as it would have to be if the fuses were not provided.

22. Switches.

(*See No. 17.*)

a. Must be placed on all service wires, either overhead or underground, in a readily accessible place, as near as possible to the point where the wires enter the building, and arranged to cut off the entire current.

Service cut-out and switch must be arranged to cut off current from all devices including meters.

In risks having private plants the yard wires running from building to building are not generally considered as service wires so that switches would not be required in each building if there are other switches conveniently located on the mains or if the generators are near at hand.

b. Must always be placed in dry, accessible places, and be grouped as far as possible. (See No. 17 *c.*) Single throw knife switches must be so placed that gravity will tend to open rather than close them. Double-throw knife switches may be mounted so that the throw will be either vertical or horizontal as preferred.

When possible, switches should be so wired that blades will be "dead" when switch is open.

If switches are used in rooms where combustible flyings would be likely to accumulate around them, they should be enclosed in dust-tight cabinets. (See note under No. 17 *b*.) Even in rooms where there are no combustible materials it is better to put all knife switches in cabinets, in order to lessen the danger of accidental short circuits being made across their exposed metal parts by careless workmen.

Up to 250 volts and thirty amperes, *approved indicating* snap switches are advised in preference to knife switches on lighting circuits about the workrooms.

It is not desirable to have switches scattered about at random and it is easier and cheaper to install and care for them properly if grouped.

If knife switches are not placed so that gravity tends to open them, weakening or breaking of the spring may allow them to partly close, causing arcs and burning. For cuts of good cabinets see Figs. 35 & 45.

c. Single pole switches must never be used as service switches nor placed in the neutral wire of a three-wire

22. Switches—Continued

system, except in the two-wire branch or tap circuit described in 21, *d*.

This, of course, does not apply to the grounded circuits of Street Railway systems.

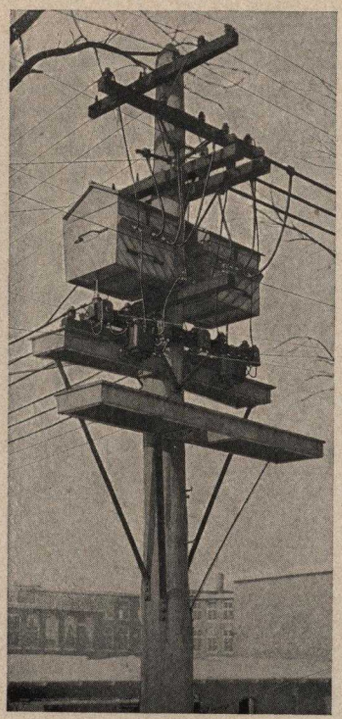


FIG. 37. EMERGENCY SWITCHES ON POLE.

Three-way switches are considered as single pole switches and must be wired so that only one pole of the circuit is carried to either switch. See Fig. 38.

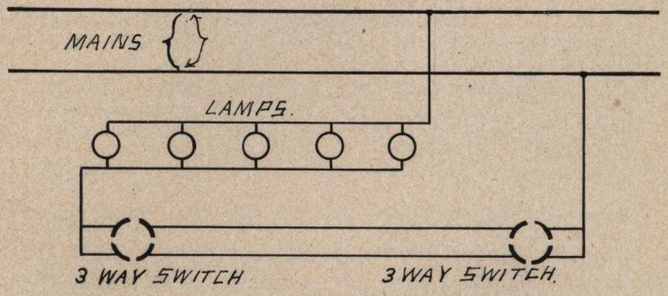


FIG. 38. THREE WAY SWITCHES PROPERLY WIRED.

d. Where flush switches or receptacles are used, whether with conduit systems or not, they must be enclosed in boxes constructed of iron or steel. No push buttons for bells, gas-lighting circuits, or the like shall be placed in the same wall plate with switches controlling electric light or power wiring.

This requires an *approved* box in addition to the porcelain enclosure of the switch or receptacle.

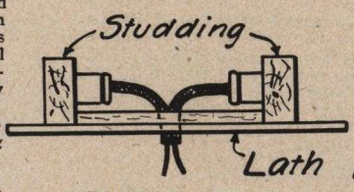


FIG. 39. SEVEN-EIGHTH INCH BLOCK FASTENED BETWEEN STUDS.

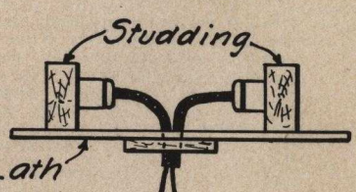


FIG. 40. THREE-QUARTER INCH BLOCK SCREWED TO LATHING.

e. Where possible, at all switch or fixture outlets, a ⅞-inch block must be fastened between studs or floor timbers flush with the back of lathing to hold tubes, and to support switches or fixtures. When this cannot be done,

Switches—Continued.

wooden base blocks, not less than ¾-inch in thickness, securely screwed to lathing, must be provided for switches, and also for fixtures which are not attached to gas pipes or conduit. See Figs. 39 and 40.

The above will not be necessary where out-let boxes are used which will give proper support for fixtures, etc.

f. Sub-bases of non-combustible, non-absorptive, insulating material, which will separate the wires at least ½-inch from the surface wired over, must be installed under all snap switches used in exposed knob and cleat work. Sub-bases must also be used in moulding work, but they may be made of hardwood.

23. Electric Heaters.

It is often desirable to connect in multiple with the heaters and between the heater and the switch controlling same, an incandescent lamp of low candle power, as it shows at a glance whether or not the switch is open, and tends to prevent its being left closed through oversight. Inspection Departments having jurisdiction may require this provision to be carried out if they deem it necessary. See Fig. 41.

Special care should be taken in arranging circuits for portable heaters to have switches so located that any department not in operation can have the current cut entirely out of it. Current should of course be cut off from all lines at night when work stops. The pilot lamp above mentioned should be so connected to the heater circuits that it would be necessary to open the main switch in order to put out this light. A red pilot light would make the indication even more conspicuous, and thus emphasize the fact that current was on these circuits in case the switch, for any reason, had been left closed.

a. Must be protected by a cut-out and controlled by indicating switches. Switches must be double pole except when the device controlled does not require more than 660 watts of energy.

Electric heaters should not be located in dusty or linty places, and practically the same precautions should be taken as required for resistance boxes (see Rule 4a), especially for stationary heaters, unless the heaters are so designed that these precautions are unnecessary for desired safety.

b. Must never be concealed, but must at all times be in plain sight.

Special permission may be given in writing by the Inspection Department having jurisdiction for departure from this rule in certain cases.

c. Flexible conductors for smoothing irons and sad irons, and for all devices requiring over 250 watts must comply with No. 45, *g*.

d. For portable heating devices the flexible conductors must be connected by an *approved* plug device, so arranged that the plug will pull cut and open the circuit in case any abnormal strain is put on the flexible conductor. This device may be stationary, or it may be placed in the cord itself. The cable or cord must be attached to the heating

23. Electric Heaters—Continued.

apparatus in such manner that it will be protected from kinking, chafing or like injury at or near the point of connection.

e. Smoothing irons, sad irons, and other heating appliances that are intended to be applied to inflammable articles, such as clothing, must conform to the above rules so far as they apply. They must also be provided with an approved stand, on which they should be placed when not in use.

An approved automatic attachment which will cut off the current when the iron is not on the stand or in actual use is desirable. Inspection Departments having jurisdiction may require this provision to be carried out if they deem it advisable.

f. Stationary electric heating apparatus, such as radiators, ranges, plate warmers, etc., must be placed in a safe location, isolated from inflammable materials, and be treated as sources of heat.

Devices of this description will often require a suitable heat-resisting material placed between the the device and its surroundings.

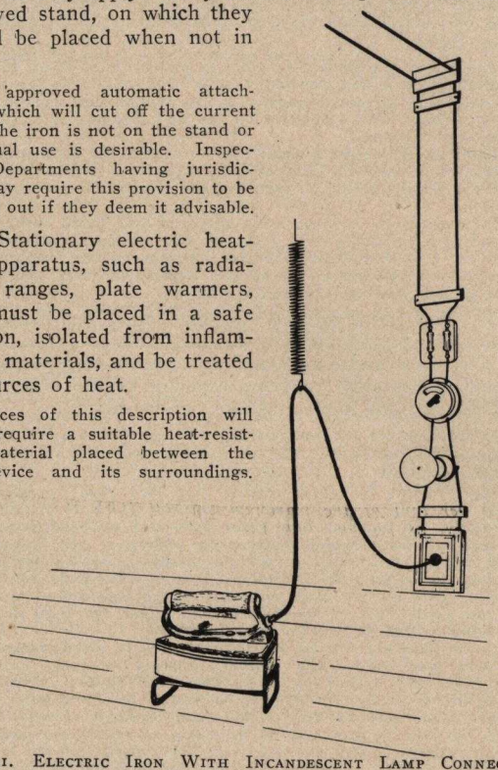


FIG. 41. ELECTRIC IRON WITH INCANDESCENT LAMP CONNECTED IN MULTIPLE.

Such protection may best be secured by installing two or more plates of tin or sheet steel with a one-inch air space between or by alternate layers of sheet steel and asbestos with a similar air space.

g. Must each be provided with name-plate, giving the maker's name and the normal capacity in volts and amperes.

LOW POTENTIAL SYSTEMS.

550 VOLTS OR LESS.

Any circuit attached to any machine, or combination of machines, which develops a difference of potential between any two wires, of over ten volts and less than 550 volts, shall be considered as a low-potential circuit, and as coming under this class, unless an approved transforming device is used, which cuts the difference of potential down to ten volts or less. The primary circuit not to exceed a potential of 3,500 volts unless the primary wires are installed in accordance with the requirements as given in No. 12 A, or are underground.

For 550 volt motor equipments a margin of ten per cent above the 550 volt limit will be allowed at the generator or transformer.

Before pressure is raised above 300 volts on any previously existing system of wiring, the whole must be strictly brought up to all of the requirements of the rules at date.

24. Wires.

GENERAL RULES.

(See also Nos. 14, 15 and 16.)

a. Must be so arranged that under no circumstances will there be a difference of potential of over 300 volts between any bare metal parts in any distributing switch or cut-out cabinet, or equivalent center of distribution.

This rule is not intended to prohibit the placing of switches or single pole cut-outs for motor systems of voltages above 300 in cabinets, but would require that the cabinets be divided by *approved* barriers so arranged that no one section shall contain more than one switch nor more than one single pole cut-out.

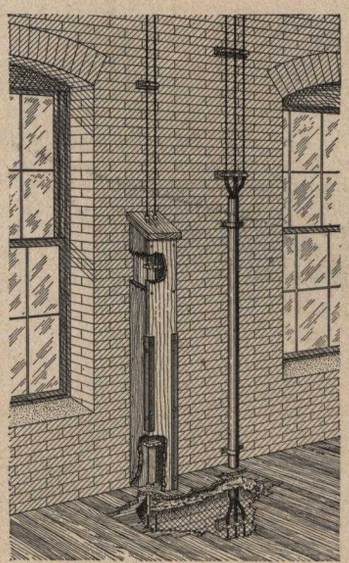


FIG. 42. PROTECTION FOR WIRES ON SIDE WALLS.

24. Wires—Continued.

b. Must not be laid in plaster, cement or similar finish, and must never be fastened with staples.

Fresh plaster and cements may be either alkaline or acid, and until finally set have a corrosive action on the insulating materials of the wires. The amount of such alkaline or acid action is not only often sufficient to destroy the insulation, but will sometimes, even injure the wire itself.

A staple driven over a wire will almost always cut through the insulation or even crack the wire itself, and this may result in an arc which would develop heat enough to set fire to the insulation.

c. Must not be fished for any great distance, and only in places where the inspector can satisfy himself that the rules have been complied with.

It is desirable to do as little fishing as possible, as the conditions of the fished wires is always somewhat uncertain.

d. Twin wires must never be used, except in conduits, or where flexible conductors are necessary.

A twin wire is made up by placing two separately insulated wires under the same insulating covering. It is unsafe for light or power work with open construction on account of the short distance between the two conductors, and the readiness with which an arc starting at one end will follow along the wire.

Twin wire may be used in conduit work with reasonable safety, however, since the liability of mechanical injury to the wire is there so small that the chance of starting an arc between them is greatly reduced. Moreover the conduit gives some added protection to the surroundings against the heat of an arc, in case one should occur.

e. Must be protected on side walls from mechanical injury. When crossing floor timbers in cellars, or in rooms where they might be exposed to injury, wires must be attached by their insulating supports to the under side of a wooden strip, not less than one-half inch in thickness, and not less than three inches in width. Instead of the running-boards, guard strips on each side of and close to the wires will be accepted. These strips to be not less than seven-eighths of an inch in thickness, and at least as high as the insulators.

Suitable protection on side walls should extend not less than five feet from the floor. This may be secured by substantial boxing, retaining an air space of one inch around the conductors, closed at the top (the wires passing through bushed holes) or by approved metal conduit, or pipe of equivalent strength.

When metal conduit or pipe is used, the insulation of each wire must be reinforced by *approved* flexible tubing extending from the insulator next below the pipe to the one next above it, unless

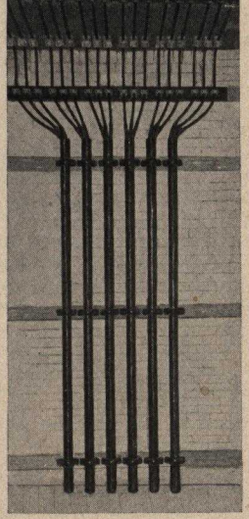


FIG. 43. IRON PIPE PROTECTION SHOWING SEPARATION OF WIRES ABOVE PIPES.

the conduit is installed according to No. 25 (sections *c* and *f* excepted), and the wire used complies with No. 47. The two or more wires of a circuit *each* with its flexible tubing (when required), if carrying alternating current *must*, or if direct current, *may* be placed within the same pipe.

In damp places the wooden boxing may be preferable because of the precautions which would be necessary to secure proper insulation if the pipe were used. With this exception, however, iron piping is considered preferable to the wooden boxing, and its use is strongly urged. It is especially suitable for the protection of wires near belts, pulleys, etc.

Fig. 42 shows both the wooden boxing and metal pipe protection. In the cut the boxing has been broken away to show the backing board on which the insulators should be mounted. This board should first be fastened to the wall, and the boxing then

24. Wires—Continued.

built around the wires as outlined in the above note. Good heavy stock should be used, as these boxes are generally subjected to considerable hard usage. Where the boxing is especially liable to knocks from trucks and the like, heavy angle irons should be securely fastened to the corners as shown. The floor bushings should have long heads, to surely prevent wash water reaching

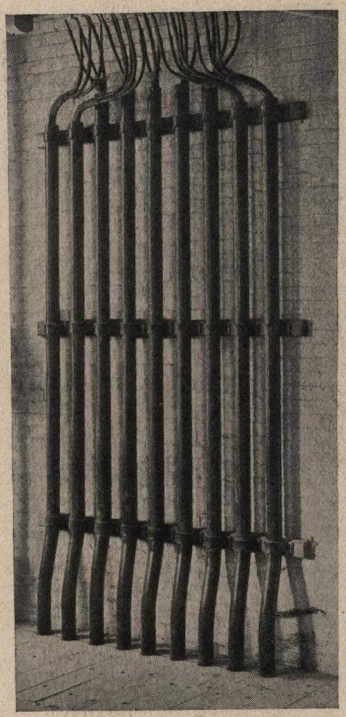


FIG. 44. IRON PIPE PROTECTION SHOWING PIPES BENT FOR OFFSET IN WALL.

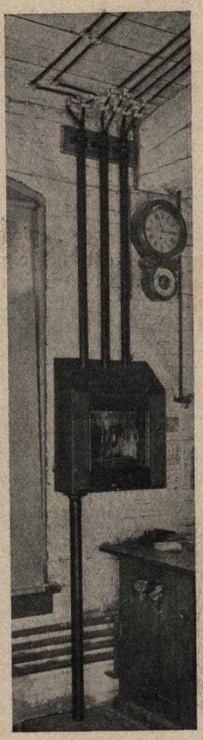


FIG. 45. CABINET WIRING PROTECTED BY IRON PIPE.

the wires, and the bushings in the top should be short, say 1½ inches, to prevent breaking. A considerable slant should be given the top to prevent its use as a shelf, and to better shed dust, etc.

If there is any liability of storage or other materials being piled in the vicinity of these wires, the protecting boxing or piping should be carried higher than 5 feet, so as to surely guard the wires from injury.

Although the cut illustrates a three-wire system protected by the flexible tubing and iron pipe, the method is, of course, entirely applicable to any system. This arrangement is excellent for several reasons:—

1. *It takes but little room, and is therefore much less in the way than the wooden boxing.*

2. *It is mechanically very strong, giving ample protection to the wire against hard knocks, etc.*

3. *It provides an excellent floor bushing, which is readily made and is not easily broken.*

4. *The amount of combustible material at this point is considerably reduced.*

Where approved lined conduit with single-braid rubber-covered wire, or unlined conduit with double-braid rubber-covered wire, is used in place of plain iron pipe, the reinforcing insulating tubing will not be required, but approved outlet bushings must be provided at each end of the conduit.

The plain iron pipe construction shown in Fig. 42 has been used in a large number of places with perfectly satisfactory results. Figs. 43 and 44 illustrate some of the applications of this arrangement in practice, on low-voltage circuits. (See also Figs. 35 and 45). In all of these cases, attention is called to the very substantial manner in which the pipes are secured in place and to the small amount of combustible material necessary with this type of construction. Fig. 44 shows how well this method can be used where offsets occur in the wall. In this cut the circuits in the five centre pipes are carried up near the wall, while the other circuits are brought forward and then pass directly up to the cleats overhead. This arrangement gives ample separation between the wires, although it is not very evident in the cut. Fig. 45 shows an excellent application of iron pipe protection for wires entering and leaving a switch cabinet.

f. When run in unfinished attics, will be considered as concealed, and when run in close proximity to water tanks or pipes, will be considered as exposed to moisture.

In unfinished attics wires are considered as exposed to mechanical injury, and must not be run on knobs on upper edge of joists.

24. Wires—Continued.

SPECIAL RULES.

For Open Work.

In dry places.

g. Must have an *approved* rubber, slow-burning weatherproof, or slow-burning insulation (see No. 41, 42 and 43.)

A slow-burning covering, that is, one that will not carry fire, is considered good enough where the wires are entirely on insulating supports. Its main object is to prevent the copper conductors from coming accidentally into contact with each other or anything else.

The "slow-burning" wire has special merit in linty and dusty places, for flyings will not readily adhere to the hard, smooth dry outer surface. The result is that the "sweeping down" process is much less severe on the wiring, which can therefore be kept in better condition. Another good point is that fire will not run rapidly along the wires, even when grouped. (See note to Rule 2 b. The wire can also be more readily drawn into flexible tubing where the iron pipe described in 24 e is used.

h. Must be rigidly supported on non-combustible, non-absorptive insulators, which will separate the wires from each other and from the surface wired over in accordance with the following table:—

Voltage.	Distance from Surface.	Distance between Wires.
0 to 300	½ inch	2½ inch.
301 to 550	1 inch	4 inch.

Rigid supporting requires under ordinary conditions, where wiring along flat surfaces, supports at least every four and one-half feet. If the wires are liable to be disturbed, the distance between supports should be shortened. In buildings of mill construction, mains of not less than No. 18 B. & S. gage, where not liable to be disturbed, may be separated about six inches, and run from timber to timber, not breaking around, and may be supported at each timber only.

This rule not to be interpreted to forbid the placing of the neutral of an Edison three-wire system in the center of a three-wire cleat where the difference of potential between the outside wires is not over 300 volts, provided the outside wires are separated two and one-half inches.

The proper distance between insulators depends largely on the surroundings. In places where ceilings are low, or where belts, shafting or other machinery may require frequent attention, insulators should be placed every few feet, in order to prevent the wires from being displaced by careless or unovoidable blows from workmen. On the other hand, with a high ceiling and no chance of derangement, a greater distance would be allowable.

The whole idea is to so rigidly secure the wires that they cannot come in contact with each other or any other conductor, if loosened by shrinkage of timbers and floors or by careless knocking.

Wires should not be "dead-ended" at rosettes, but should always be carried beyond them for a few inches and securely fastened with porcelain cleats.

See Fig. 33 for illustration of good wiring for buildings of mill construction.

In damp places or buildings especially subject to moisture or to acid or other fumes to injure the wires or their insulations:—

i. Must have an *approved* insulating covering.

For protection against water, rubber insulation must be used. For protection against corrosive vapors, either weatherproof or rubber insulation must be used. (See Nos. 41 and 44).

j. Must be rigidly supported on non-combustible, non-absorptive insulators, which separate the wire at least one inch from the surface wired over, and must be kept apart at least two and one-half inches for voltages up to 300, and four inches for higher voltages.

Rigid supporting requires under ordinary conditions, where wiring over flat surfaces, supports at least every four and one-half feet. If the wires are liable to be disturbed, the distance between supports should be shortened. In buildings of mill construction, mains of not less than No. 8 B. & S. gage, where not liable to be disturbed, may be separated about six inches, and run from timber to timber, not breaking around, and may be supported at each timber only.

For Moulding Work (Wooden and Metal).

(See No. 25 A.)

k. Must have an *approved* rubber insulating cover. (For wooden moulding see No. 41, for metal moulding see No. 47.)

The absence of the porcelain insulators required for open work, and the close proximity into which the wires are brought, makes it necessary to have the best of insulation on them.

l. Must never be placed in either metal or wooden moulding in concealed or damp places, or where the difference of potential between any two wires in the same moulding is over 300 volts. *Metal* mouldings must not be used for circuits requiring more than 660 watts of energy.

As a rule, wooden moulding should not be placed directly against a brick wall, as the wall is likely to "sweat" and thus introduce moisture back of the moulding.

24. Wires—Continued.

If water should soak into the wood, it might cause leakage of current between the wires, charring the wood and starting a fire which would not be immediately discovered.

The Metal Mouldings Are Not Water-tight.

It is to be understood that the sole object of the moulding is to furnish a convenient and fairly good-looking runway, in which the wires are protected from mechanical injury. Nails used for fastening on the capping must be very carefully driven, so as to avoid injuring the insulation, and must never be used to hold the wires in the grooves.

m. Must for alternating current systems if in metal moulding have the two or more wires of a circuit installed in the same moulding.

It is advised that this be done for direct current systems also, so that they may be changed to alternating systems at any time, induction troubles preventing such a change if the wires are in separate mouldings.

For Conduit Work.

n. Must have an *approved* rubber insulating covering (see No. 47.)

Here, too, the conductors need the best of insulating covering, as there is no other separation between them.

o. Must not be drawn in until all mechanical work on the building has been, as far as possible, completed.

Conductors in vertical circuit risers must be supported within the conduit system in accordance with the following table:—

No. 14 to 0 every 100 feet.
No. 00 to 0000 every 80 feet.
0000 to 350,000 C. M. every 60 feet.
350,000 C. M. to 500,000 C. M. every 50 feet.
500,000 C. M. to 750,000 C. M. every 40 feet.
750,000 C. M. every 35 feet.

A turn of 90 degrees in the conduit system will constitute a satisfactory support, as per above table.

The following methods of supporting cables are recommended:—

1. Junction boxes may be inserted in the conduit system at the required intervals, in which insulating supports of *approved* type must be installed and secured in a satisfactory manner so as to withstand the weight of the conductors attached thereto, the boxes to be provided with proper covers.
2. Cables may be supported in *approved* junction boxes on two or more insulating supports so placed that the conductors will be deflected at an angle of not less than 90 degrees, and carried a distance of not less than twice the diameter of the cable from its vertical position. Cables so suspended may be additionally secured to these insulators by tie wires.

Other methods, if used, must be approved by the Inspection Department having jurisdiction.

This makes it absolutely necessary that the conduit should be complete from one junction box to another, and that all joints be carefully made. If wires were laid in the conduits while the latter were being installed, it would be very easy to neglect these points.

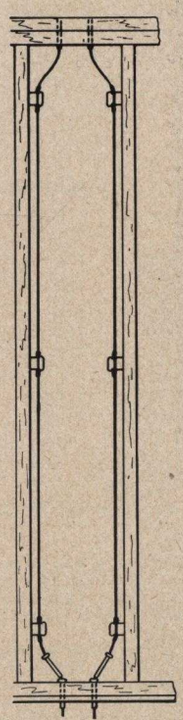


FIG. 46. SHOWING THE CUSTOMARY METHOD OF PROTECTING WIRES WHERE SUBJECTED TO DROPPINGS OF PLASTER.

p. Must, for alternating current systems, have the two or more wires of a circuit drawn in the same conduit.

It is advised that this be done for direct current systems also, so that they may be changed to alternating systems at any time induction troubles preventing such a change if the wires are in separate conduits.

The same conduit must never contain circuits of different systems, but may contain two or more circuits of the same system.

With alternating current systems, if the wires of the same circuit are in different iron conduits, there will be trouble from inductive losses, and under certain conditions the conduits may become dangerously heated. This trouble disappears if the two or more wires of the same circuit are drawn into the same conduit. The placing of two or more circuits in the same conduit should be avoided as far as possible.

24. Wires—Continued.

For Concealed "Knob and Tube" Work.

q. Must have an *approved* rubber insulating covering (see No. 41.)

In concealed work, the condition of the wire is often unknown, so that the best insulation is necessary for safety.

r. Must be rigidly supported on non-combustible, non-absorptive insulators which separate the wire at least one inch from the surface wired over. Should preferably be run singly on separate timbers, or studdings, and must be kept at least five inches apart.

Must be separated from contact with the walls, floor timbers and partitions through which they may pass by non-combustible, non-absorptive insulating tubes, such as glass or porcelain.

Rigid supporting requires, under ordinary conditions, where wiring along flat surface, supports at least every four and one-half feet. If the wires are liable to be disturbed the distance between supports should be shortened.

At distributing centers, outlets or switches where space is limited and the five-inch separation cannot be maintained, each wire must be separately encased in a continuous length of approved flexible tubing.

Wires passing through timbers at the bottom of plastered partitions must be protected by an additional tube extending at least four inches above the timber. See Fig. 46.

It is believed that the use of a few extra knobs or cleats and a generous supply of tubes is advisable in such places, where the circuits are entirely concealed and any derangement of them could not, therefore, be seen.

s. When in a concealed knob and tube system, it is impracticable to place the whole of a circuit on non-combustible support of glass or porcelain, that portion of the circuit which cannot be so supported must be installed with *approved* metal conduit, or *approved* armored cable (see No. 24 *t*), except that if the difference of potential between the wires is not over 300 volts, and if the wires are not exposed to moisture, they may be fished if separately encased in *approved* flexible tubing, extending in continuous lengths from porcelain support to porcelain support, from porcelain support to outlet, or from outlet to outlet.

There can, of course, be no assurance that such fished wires do not lie in close contact with gas or water pipes, or other wires, and so there is need of the protecting conduit.

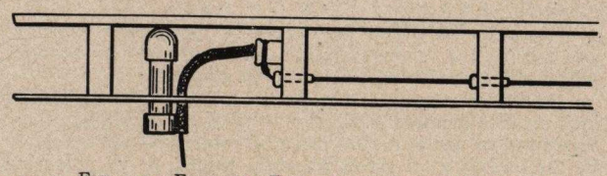


FIG. 47. FLEXIBLE TUBING ON OUTLET WIRES.

t. Mixed concealed knob and tube work as provided for in No. 24*s*, must comply with requirements of No. 24 *n* to *p*, and No. 25, when conduit is used, and with requirements of No. 24 A, when armored cable is used.

u. Must at all outlets, except where conduit is used, be protected by *approved* flexible insulating tubing, extending in continuous lengths from the last porcelain support to at least one inch beyond the outlet. In the case of combination fixtures the tubes must extend at least flush with outer end of gas pipe. See Fig. 47.

It is recommended but not required that *approved* outlet boxes or plates be installed at all outlets in concealed "knob and tube" work, the wires to be protected by *approved* flexible insulating tubing, extending in continuous lengths from the last porcelain support into the box.

For Fixture Work.

v. Must have an *approved* rubber insulating covering (see No. 46), and be not less in size than No. 18 B. & S. gage.

The wire covering lies in contact with the metal of the fixtures, so that a first-class insulator, like rubber, is necessary.

It is very undesirable to use wires as small as No. 18 as they have but little mechanical strength and are easily broken by vibration of the fixture. They are only to be used in places where it is absolutely impossible to put a larger wire. Stranded wires are preferable to solid wires, as they are much less likely to break.

w. Supply conductors, and especially the splices to fixture wires, must be kept clear of the grounded part of gas pipes, and, where shells or outlet boxes are used, they must be made sufficiently large to allow the fulfillment of this requirement.

x. Must, when fixtures are wired outside, be so secured as not to be cut or abraded by the pressure of the fastenings or motion of the fixture.

24. Wires—Continued.

y. Under no circumstances must there be a difference of potential of more than 300 volts between wires contained in or attached to the same fixture.

24 A. Armored Cables.

a. Must be continuous from outlet to outlet or to junction boxes, and the armor of the cable must properly enter and be secured to all fittings, and the entire system must be mechanically secured in position.

In case of underground service connections and main runs, this involves running such armored cable continuously into a main cut-out cabinet or gutter surrounding the panel board, as the case may be.

b. Must be equipped at every outlet with an *approved* outlet box or plate, as required in conduit work.

Outlet plates must not be used where it is practicable to install outlet boxes.

The outlet box or plate shall be so installed that it will be flush with the finished surface, and if this surface is broken it shall be repaired so that it will not show any gaps or open spaces around the edge of the outlet box or plate.

In buildings already constructed where the conditions are such that neither outlet box nor plate can be installed, these appliances may be omitted by special permission of the Inspection Department having jurisdiction, provided the armored cable is firmly and rigidly secured in place.

c. Must have the metal armor of the cable permanently and effectively grounded.

It is essential that the metal armor of such systems be joined so as to afford electrical conductivity sufficient to allow the largest fuse or circuit-breaker in the circuit to operate before a dangerous rise in temperature in the system can occur. Armor of cables and gas pipes must be securely fastened in metal outlet boxes so as to secure good electrical connection. Where boxes used for centers of distribution do not afford good electrical connection the armor of the cables must be joined around them by suitable bond wires. Where sections of armored cable are installed without being fastened to the metal structure of buildings or grounded metal piping, they must be bonded together and joined to a permanent and efficient ground connection.

d. When installed in so-called fireproof buildings in course of construction or afterwards if concealed, or where it is exposed to the weather, or in damp places such as breweries, stables, etc., the cable must have a lead covering at least one thirty-second inch in thickness placed between the outer braid of the conductors and the steel armor.

e. Where entering junction boxes, and at all other outlets, etc., must be provided with *approved* terminal fittings, which will protect the insulation of the conductors from abrasion, unless such junction or outlet boxes are specially designed and approved for use with the cable.

f. Junction boxes must always be installed in such a manner as to be accessible.

g. For alternating current systems must have the two or more conductors of the cable enclosed in one metal armor.

This is necessary in order to avoid heating of armor and other troubles due to induction, which occur if each conductor were separately encased.

25. Interior Conduits.

(*See also Nos. 24 n to p.*)

The object of a tube or conduit is to facilitate the insertion or extraction of the conductors and to protect them from mechanical injury. Tubes or conduits are to be considered merely as raceways, and are not to be relied upon for insulation between wire and wire, or between the wire and the ground.

a. No conduit tube having an internal diamater of less than five-eights of an inch shall be used. Measurements to be taken inside of metal conduits.

It has been found in practice with sizes smaller than this, that the smallest wire permitted by Rule 14 a cannot be readily drawn in and out of the conduit.

b. Must be continuous from outlet to outlet or to junction boxes, and the conduit must properly enter, and be secured to all fittings and the entire system must be mechanically secured in position.

In case of service connections and main runs, this involves running each conduit continuously into a main cut-out cabinet or gutter surrounding the panel board, as the case may be.

They must be continuous, in order that the wires may be readily drawn in after the conduit system is completed, and also to ensure that the wire is protected throughout its whole length.

c. Must be first installed as a complete conduit system, without the conductors.

d. Must be equipped at every outlet with an *approved* outlet box or plate.

Outlet plates must not be used where it is practicable to install outlet boxes.

25. Interior Conduits—Continued.

The outlet box or plate shall be so installed that it will be flush with the finished surface, and if this surface is broken it shall be repaired so that it will not show any gaps or open spaces around the edge of the outlet box or plate.

In buildings already constructed where the conditions are such that neither outlet box nor plate can be installed, these appliances may be omitted by special permission of the Inspection Department having jurisdiction, providing the conduit ends are bushed and secured.

e. Metal conduits where they enter junction boxes, and at all other outlets, etc., must be provided with *approved* bushings fitted so as to protect wire from abrasion, except when such protection is obtained by the use of *approved* nipples, properly fitted in boxes or devices.

f. Must have the metal of the conduit permanently and effectually grounded.

It is essential that the metal of conduit systems be joined so as to afford electrical conductivity sufficient to allow the largest fuse or circuit breaker in the circuit to operate before a dangerous rise in temperature in the conduit system can occur. Conduits and gas pipes must be securely fastened in metal outlet boxes so as to secure good electrical connections. Where boxes used for centers of distribution do not afford good electrical connection, the conduits must be joined around them by suitable bond wires. Where sections of metal conduits are installed without being fastened to the metal structure of buildings or grounded metal piping, they must be bonded together and joined to a permanent and efficient ground connection.

It is rarely possible to perfectly insulate a conduit system throughout, and a positive ground is therefore required, so as to provide a definite path for leaking currents and thus prevent them from escaping through parts of a building, etc., where they might do harm.

g. Junction boxes must always be installed in such a manner as to be accessible.

h. All elbows or bends must be so made that the conduit or lining of same will not be injured. The radius of the curve of the inner edge of any elbow not to be less than three and one-half inches. Must have not more than the equivalent of four-quarter bends from outlet to outlet, the bends at the outlets not being counted.

25 A. Metal Mouldings.

(*See also No. 24 k to m.*)

a. Must be continuous from outlet to outlet, to junction boxes, or approved fittings designed especially for use with metal mouldings, and must at all outlets be provided with approved terminal fittings which will protect the insulation of conductors from abrasion, unless such protection is afforded by the construction of the boxes or fittings.

b. Such mouldings where passing through a floor must be carried through an iron pipe extending from the ceiling below to a point five feet above the floor, which will serve as an additional mechanical protection and exclude the presence of moisture often prevalent in such locations.

In residences, office buildings and similar locations where appearance is an essential feature, and where the mechanical strength of the moulding itself is adequate, this ruling may be modified to require the protecting piping from the ceiling below to a point at least three inches above the flooring.

c. Backing must be secured in position by screws or bolts, the heads of which must be flush with the metal.

d. The metal of the moulding must be permanently and effectively grounded, and must be so installed that adjacent lengths of moulding will be mechanically and electrically secured at all points.

It is essential that the metal of such systems be joined so as to afford electric conductivity sufficient to allow the largest fuse in the circuit to operate before a dangerous rise of temperature in the system can occur. Mouldings and gas pipes must be securely fastened in metal outlet boxes, so as to secure good electrical connection. Where boxes used for the center of distribution do not afford good electrical connection the metal moulding must be joined around them by suitable bond wires. Where sections are installed without being fastened to the metal structure of the building or grounded metal piping, they must be bonded together or joined to permanent and effective ground connection.

e. Must be installed so that for alternating systems the two or more wires of a circuit will be in the same metal moulding.

It is advised that this be done for direct systems also, so that they may be changed to the alternating system at any time, induction troubles preventing such change if the wires are in separate mouldings.

26. Fixtures.

(*See also Nos. 22 e, 24 v to y.*)

a. Must when supported from the gas piping or any grounded metal work of a building be insulated from such piping or metal work by means of *approved* insulating joints placed as close as possible to the ceiling or walls.

Fixtures—Continued.

Gas outlet pipes must be protected above the insulating joint by *approved* insulating tubing, and where outlet tubes are used they must be of sufficient length to extend below the insulating joint, and must be so secured that they will not be pushed back when the canopy is put in place.

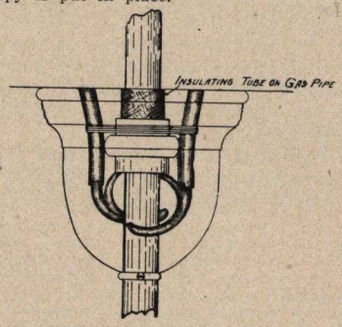


Fig. 48. Fixture Insulated from Gas Piping and Showing Wires Protected by Flexible Tubing.

Where canopies are placed against plaster walls or ceilings in fireproof buildings, or against metal walls or ceilings, or plaster walls or ceilings on metallic lathing in any class of buildings, they must be thoroughly and permanently insulated from such walls or ceilings. See Fig. 48.

Where incandescent lamp fixtures are hung from gas pipes or combined with gas fixtures, it is highly important to have them well insulated from the grounded portion of the gas pipe. If this is not done, any injury to the insulating covering of the wire inside the fixture would ground one side of the electric system, and this would probably result in dangerous arcs. Sometimes these arcs melt holes in the gas pipe and ignite the escaping gas. Most combination fixtures have not sufficient room in them to permit the use of wire having insulation of a standard thickness, and this increases the chances of the insulation becoming sufficiently abraded to allow the conductors to come in contact with the fixture. The best and usual way to insulate the fixture from the ground is by interposing between it and the gas supply pipes what is called an insulating joint, which is, in effect, a piece of gas pipe made of insulating material, such as porcelain or hard rubber.

b. Must have all burs or fins removed before the conductors are drawn into the fixture.

Because such sharp edges are liable to cut and tear the insulation of the wire when it is drawn into the fixture or, in time, by jarring of the fixture after it is in position.

c. Must be tested for "contacts" between conductors and fixture, for "short circuits" and for ground connections before it is connected to its supply conductors.

d. All fixture arms made of tubing smaller than ½ inch outside diameter, also the arms of all one-light brackets, must be secured after they are screwed into position by the use of a set-screw properly placed, or by soldering or cementing or some equally good method to prevent the arms from becoming unscrewed. Arms must not be made of tubing lighter than No. 18 B. & S. gage, and must have at screw joints not less than five threads all engaging. This rule does not apply to fixtures or brackets with cast or heavy arms.

27. Sockets.

a. In rooms where inflammable gases may exist the incandescent lamp and socket must be enclosed in a

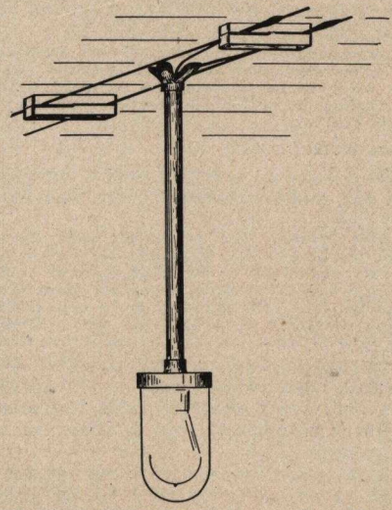


Fig. 49. Vapor Proof Globe Supported on Iron Pipe Hanger.

27. Sockets—Continued.

vapor-tight globe, and supported on a pipe-hanger, wired with *approved* rubber-covered wire (see No. 41) soldered directly to the circuit. (See Fig. 49.)

b. In damp or wet places "waterproof" sockets must be used. Unless made up on fixtures, they must be hung

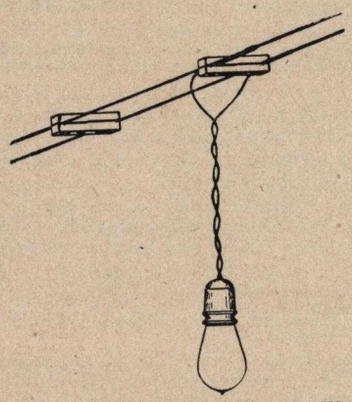


FIG. 50. WATERPROOF SOCKET IN DAMP OR WET PLACE.

by separate *stranded* rubber-covered wires not smaller than No. 14 B. & S. gage, which should preferably be twisted together when the pendant is over three feet long. (See Fig. 50.)

These wires must be soldered direct to the circuit wires but supported independently of them.

This form of construction is clearly shown in Figs. 50 and 51, in which is also indicated a method of supporting the pendant so that all strain is removed from the connection to the overhead wires.

c. Key sockets will not be approved if installed over specially inflammable stuff, or where exposed to flyings of combustible material.

28. Flexible Cord.

a. Must have an *approved* insulation and covering (see No. 45).

b. Must not be used where the difference of potential between the two wires is over 300 volts.

The above rule does not apply to the grounded circuits in street railway property.

c. Must not be used as a support for clusters.

It is not strong enough mechanically to safely sustain much weight.

d. Must not be used except for pendants, wiring of fixtures, portable lamps or motors, and portable heating apparatus.

FIG. 51. PENDANT WITH REINFORCED FLEXIBLE CORD.

The practice of making the pendants unnecessarily long and then looping them up with cord adjusters is strongly advised against. It offers a temptation to carry about lamps which are intended to hang freely in the air, and the cord adjusters wear off the insulation very rapidly.

For all portable work, including those pendants which are liable to be moved about sufficiently to come in contact with surrounding objects, flexible wires and cables especially designed to withstand this severe service are on the market, and should be used.

(See No. 45*f*).

The standard socket is threaded for one-eighth inch pipe, and if it is properly bushed, the reinforced flexible cord will not go into it, but this style of cord may be used with sockets threaded for three-eighths inch pipe, and provided with substantial insulating bushings. The cable to be supported independently of the overhead circuit by a single cleat, and the two conductors then separated and soldered to the overhead wires.

The bulb of an incandescent lamp frequently becomes hot enough to ignite paper, cotton and similar readily ignitible materials, and in order to prevent it from coming in contact with such materials, as well as to protect it from breakage, every portable lamp should be surrounded with a substantial wire guard.

28. Flexible Cord—Continued.

The chances for short-circuits in flexible cord are considerable, as the wires of opposite polarity are brought very near together. As a result of continued bending in handling some of the fine wires may break, and the loose, sharp ends may then puncture the insulation and form a short-circuit with the other conductor. Or the insulation may deteriorate or become sufficiently worn to allow the bare wires to come into contact with each other. The arc formed at the instant the short circuit occurs is liable to set fire to the insulation of the wire if it be at all of a combustible nature. This will sometimes occur even if the circuit is instantly opened by melting of the fuses. It is for these reasons that it is desirable to limit the use of flexible cord to those places where nothing else is suitable.

e. Must not be used in show windows except when provided with an *approved* metal armor.

Because a defective cord is very liable to set fire to the inflammable material about it. Records show an unfortunately large number of fires caused by the use of common flexible cord in show windows.

f. Must be protected by insulating bushings where the cord enters the socket.

The hole through which the wire must enter the socket is ordinarily threaded for attachment to fixtures. The sharp thread would soon cut through the insulation of the cord and cause a short-circuit, were it not for the bushing.

g. Must be so suspended that the entire weight of the socket and lamp will be borne by some *approved* device under the bushing in the socket, and above the point where the cord comes through the ceiling block or rosette, in order that the strain may be taken from the joints and binding screws.

This is usually accomplished by knots in the cord inside the socket and rosette.

It is good practice to have the ends of the conductors dipped in melted solder where they are fastened under the binding screws. This binds the fine wires together and leaves no loose ends to make short-circuits inside the socket.

29. Arc Lamps on Constant-Potential Circuits.

a. Must have a cut-out (see No. 17 *a*) for each lamp or each series of lamps.

The branch conductors should have a carrying capacity about fifty per cent. in excess of the normal current required by the lamp, to provide for heavy current required when lamp is started, or when carbons become stuck without overfusing the wires.

b. Must only be furnished with such resistances or regulators as are enclosed in non-combustible material, such resistances being treated as sources of heat. Incandescent lamps must not be used for this purpose.

Even when the arc lamp is burning properly, these resistances are quite hot, and they may be melted by excessive current if the lamp fails to burn as it should.

For general inside use, especially in dusty or linty places, the casing about the resistances should be so constructed as to absolutely prevent the accumulation of lint, etc., inside, where it can become ignited, due to contact with the hot resistance. This is an important point, as several fires due to this cause have occurred where lamps with open casings have been used in textile mills. The switch on the lamp should also be enclosed so that lint cannot collect on it and be ignited when the switch is opened. The lamp as a whole should be so designed and installed that no part upon which combustible flyings may collect can become dangerously hot under conditions liable to be met with in practice.

c. Must be supplied with globes and protected by spark arresters and wire netting around the globe, as in the case of series arc lamp (see No. 19.)

Outside arc lamps must be suspended at least eight feet above sidewalks. Inside arc lamps must be placed out of reach or suitably protected.

d. Lamps when arranged to be raised and lowered, either for carboning or other purposes, shall be connected up with stranded conductors from the last point of support to the lamp, when such conductor is larger than No. 14 B. & S. gage.

30. Economy Coils.

a. Economy and compensator coils for arc lamps must be mounted or non-combustible, non-absorptive, insulating supports such as glass or porcelain, allowing an air space of at least one inch between frame and support, and must in general be treated as sources of heat.

Practically the same precautions in locating and mounting these devices should be taken as with resistance boxes, etc. (See Rule 4.) This would require that they be mounted on a slate base or equivalent, which in turn is fastened to the wall or other support, the attachments to be independent of each other and the base to be of such size as to give a continuous separation between the device and the support. It will not be satisfactory to mount these devices on porcelain knobs.

31. Decorative Lighting Systems.

a. Special permission may be given in writing by the Inspection Department having jurisdiction for the temporary installation of *approved* Systems of Decorative Lighting, provided the difference of potential between the wires of any circuit shall not be over 150 volts and also provided that no group of lamps requiring more than 1,320 watts shall be dependent on one cut-out.

No "System of Decorative Lighting" to be allowed under this rule which is not listed in the Supplement to the National Electrical Code containing list of approved fittings.

31 A. Theatre Wiring.

(For rules governing Moving Picture Machine, see No. 65A.)

All wiring, apparatus, etc., not specifically covered by special rules herein given must conform to the Standard Rules and Requirements of the National Electrical Code.

In so far as these Rules and Requirements are concerned, the term "theatre" shall mean a building or part of a building in which it is designed to make a presentation of dramatic, operatic or other performances or shows for the entertainment of spectators which is capable of seating at least four hundred persons, and which has a stage for such performances that can be used for scenery and other stage appliances.

a. Services.

1. Where source of supply is outside of building, there must be at least two separate and distinct services where practicable, fed from separate street mains, one service to be of sufficient capacity to supply current for the entire equipment of theatre, while the other service must be at least of sufficient capacity to supply current for all emergency lights.

By "emergency lights" are meant exit lights and all lights in lobbies, stairways, corridors and other portions of theatre to which the public have access which are normally kept lighted during the performance.

2. Where source of supply is an isolated plant within same building, an auxiliary service of at least sufficient capacity to supply all emergency lights must be installed from some outside source, or a suitable storage battery within the premises may be considered the equivalent of such service.

b. Stage.

1. All permanent construction on stage side of proscenium wall must be *approved* conduit, with the exception of border and switchboard wiring.

2. *Switchboards.*—Must be made of non-combustible, non-absorptive material, and where accessible from stage level must be protected by an *approved* guard-rail to prevent accidental contact with live parts on the board.

3. *Footlights*:—

a. Must be wired in *approved* conduit, each lamp receptable being enclosed within an *approved* outlet box, the whole to be enclosed in a steel trough, metal to be of a thickness not less than No. 20 gage, or each lamp receptacle may be mounted on or in an iron or steel box so constructed as to enclose all the wires and live parts of receptacles.

b. Must be so wired that no set of lamps requiring more than 1,320 watts will be dependent on one cut-out.

4. *Borders*:—

a. Must be constructed of steel of a thickness not less than No. 20 gage, treated to prevent oxidization, be suitably stayed and supported by a metal framework, and so designed that flanges of reflectors will protect lamps.

b. Must be so wired that no set of lamps requiring more than 1,320 watts will be dependent upon one cut-out.

c. Must be wired in *approved* conduit, each lamp receptacle to be enclosed within an *approved* outlet box, the whole to be enclosed in a steel trough, or each lamp receptacle may be mounted on or in the cover of a steel box so constructed as to enclose all the wires and the live parts of receptacles, metal to be of a thickness not less than No. 20 gage.

d. Must be provided with suitable guards to prevent scenery or other combustible material coming in contact with lamps.

31A. Theatre Wiring—Continued.

e. Cables must be continuous from stage switchboard to border; conduit construction must be used from switchboard to point where cables must be flexible to permit of the raising and lowering of border, and flexible portion must be enclosed in an *approved* fireproof hose or braid and be suitably supported.

Junction Boxes will be allowed on fly floor and rigging loft in existing theatres where the wiring has been completed and approved by Inspection Department having jurisdiction.

f. For the wiring of the border proper, wire with slow burning insulation should be used.

g. Must be suspended with wire rope, same to be insulated from border by at least two *approved* strain insulators properly inserted.

5. *Stage Pockets.*—Must be of approved type controlled from switchboard, each receptacle to be of not less than fifty amperes rating, and each receptacle to be wired with a separate circuit to its full capacity.

6. *Proscenium Side Lights.*—Must be so installed that they cannot interfere with the operation of or come in contact with curtain.

7. *Scene Docks.*—Where lamps are installed in Scene Docks, they must be so located and installed that they will not be liable to mechanical injury.

8. *Curtain Motors.*—Must be of ironclad type and installed so as to conform to the requirements of the National Electrical Code. (See No. 8.)

9. *Control for Stage Flues:*—

a. In cases where dampers are released by an electric device, the electric circuit operating same must be normally closed.

b. Magnet operating damper must be wound to take full voltage of circuit by which it is supplied, using no resistance device, and must not heat more than normal for apparatus of similar construction. It must be located in loft above scenery, and be installed in a suitable iron box with a tight self-closing door.

c. Such dampers must be controlled by at least two standard single pole switches mounted within *approved* iron boxes provided with self-closing doors without lock or latch, and located, one at the Electrician's station, and others as designated by the Inspection Department having jurisdiction.

c. Dressing Rooms.

1. Must be wired in *approved* conduit, except that in existing buildings where it is impracticable to install *approved* conduit, *approved* armored cable may be used, provided it is installed in accordance with No. 24 A.

2. All pendant lights must be equipped with *approved* reinforced cord or cable.

3. All lamps must be provided with *approved* guards.

d. Portable Equipments.

1. *Arc lamps* used for stage effects must conform to the following requirements:—

a. Must be constructed entirely of metal except where the use of *approved* insulating material is necessary.

b. Must be substantially constructed, and so designed as to provide for proper ventilation, and to prevent sparks being emitted from lamps when same is in operation, and mica must be used for frame insulation.

c. Front opening must be provided with a self-closing hinged door frame in which wire gauze or glass must be inserted, excepting lens lamps, where the front may be stationary, and a solid door be provided on back or side.

d. Must be provided with a one-sixteenth-inch iron or steel guard having a mesh not larger than one inch, and be substantially placed over top and upper half of sides and back of lamp frame; this guard to be substantially riveted to frame of lamp and to be placed at a distance of at least two inches from the lamp frame.

e. Switch on standard must be so constructed that accidental contact with any live portion of same will be impossible.

f. All stranded connections in lamp and at switch and rheostat must be provided with approved lugs.

g. Rheostat, if mounted on standard, must be raised to a height of at least three inches above floor line, and in addition to being properly enclosed must

31A. Theatre Wiring—Continued.

be surrounded with a substantially attached metal guard having a mesh not larger than one square inch, which guard is to be kept at least one inch from outside frame of rheostat.

h. A competent operator must be in charge of each arc lamp, except that one operator may have charge of two lamps when they are not more than ten feet apart, and are so located that he can properly watch and care for both lamps.

2. *Bunches:—*

a. Must be substantially constructed of metal, and must not contain any exposed wiring.

b. Cable feeding same must be bushed in an *approved* manner where passing through the metal, and must be properly secured to prevent any mechanical strain from coming on the connections.

3. *Strips:—*

a. Must be constructed of steel of a thickness not less than No. 20 gage, treated to prevent oxidization, and suitably stayed and supported by metal framework.

b. Cable feeding same must be bushed in an *approved* manner where passing through the metal, and must be properly secured to prevent any mechanical strain from coming on the connections.

4. *Portable Plugging Boxes.*—Must be constructed so that no current carrying part will be exposed, and each receptacle must be protected by *approved* fuses mounted on slate or marble bases and enclosed in a fireproof cabinet equipped with self-closing doors. Each receptacle must be constructed to carry thirty amperes without undue heating, and the bus-bars must have a carrying capacity equivalent to the current required for the total number of receptacles, allowing thirty amperes to each receptacle, and *approved* lugs must be provided for the connection of the master cable.

5. *Pin Plug Conductors:—*

a. When of *approved* type may be used to connect *approved* portable lights and appliances.

b. Must be so installed that the "female" part of plug will be on the live end of cable, and must be so constructed that tension on the cable will not cause any serious mechanical strain on the connection.

6. *Lights on scenery.*—Where brackets are used they must be wired entirely on the inside, fixture stem must come through to the back of the scenery and end be properly bushed.

31A. Theatre Wiring—Continued.

7. *String or Festoon Lights.*—Wiring for same should be *approved* cable, joints where taps are taken from same for lights to be propely made, soldered and taped, and where lamps are used in lanterns or similar devices lamps must be provided with *approved* guards. Where taps are taken from cable, they should be so staggered that joints of different polarity will not come immediately opposite each other and must be properly protected from strain.

8. *Special Electrical Effects.*—Where devices are used for producing special effects such as lightning, waterfalls, etc., the apparatus must be so constructed and located that flames, sparks, etc., resulting from the operation cannot come in contact with combustible material.

e. Auditorium.

1. All wiring must be installed in *approved* conduit except that in existing buildings where it is impracticable to install *approved* conduit, *approved* armored cable may be used, provided it is installed in accordance with No. 24 A.

2. All fuses used in connection with illuminating all parts of the house used by the audience must be installed in fireproof enclosures so constructed that there will be a space of at least six inches between the fuses and the sides and face of enclosure.

3. Exit lights must not have more than one set of fuses between same and service fuses.

4. Exit lights and all lights in halls, corridors or any other part of the building used by the audience, except the general auditorium lighting, must be fed independently of the stage lighting, and must be controlled only from the lobby or other convenient place in front of the house.

5. Every portion of the theatre devoted to the use or accommodation of the public, also all outlets leading to the streets and including all open courts, corridors, stairways, exits and emergency exit stairways, should be well and properly lighted during every performance, and the same should remain lighted until the entire audience has left the premises.

34. Lighting and Power from Railway Wires.

a. Must not be permitted, under any pretense, in the same circuit with trolley wires with a ground return, except in electric railway cars, electric car houses and their power stations; nor shall the same dynamo be used for both purposes.

Lighting from trolley wires is forbidden because of the danger of introducing into a building a circuit which has so much capacity back of it and which is thoroughly connected with the earth on one side. The inevitable fluctuation in voltage would also frequently require overfusing of the lighting circuits to prevent blowing fuses under normal conditions.

HIGH-POTENTIAL SYSTEMS.

550 TO 3,500 VOLTS.

Any circuit attached to any machine or combination of machines which develops a difference of potential between any two wires, of over 550 volts and less than 3,500 volts, shall be considered as a high-potential circuit, and as coming under that class, unless an approved transforming device is used, which cuts the difference of potential down to 550 volts or less.

(See note following first paragraph under Low Potential systems.

35. Wires.

(*See also Nos. 14, 15 and 16.*)

a. Must have an *approved* rubber-insulating covering (see No. 41).

b. Must be always in plain sight and never encased, except as provided for in No. 8 *b*, or where required by the Inspection Department having jurisdiction.

c. Must (except as provided for in No. 8 *b*), be rigidly supported on glass or porcelain insulators, which raise the wire at least one inch from the surface wired over, and must be kept about eight inches apart.

Rigid supporting requires under ordinary conditions, where wiring along flat surfaces, supports at least about every four and one-half feet. If the wires are unusually liable to be disturbed, the distance between supports should be shortened.

In buildings of mill construction, mains of not less than No. 8 B. & S. gage, where not liable to be disturbed, may be separated about ten inches and run from timber to timber, not breaking around, and may be supported at each timber only.

35. Wires—Continued.

The proper distance between insulators depends largely on the surroundings. In places where ceilings are low, or where belts, shafting or other machinery may require frequent attention, insulators should be placed every few feet, in order to prevent the wires from being displaced by careless or unavoidable blows from workmen. On the other hand, with a high ceiling and no chance of derangement, a greater distance would be allowable.

The whole idea is to so rigidly secure the wires that they cannot come in contact with each other or any other conductors if lossened by shrinkage of timbers and floors, or by careless knocking.

The covering of the wires should not be depended on for insulation. The wire should be so supported on the glass or porcelain insulators that, even if it were bare, the insulation of the system would still be excellent. The office of the covering will then be chiefly to protect the wires from accidental contacts of any kind.

d. Must be protected on side walls from mechanical injury by a substantial boxing, retaining an air space of one inch around the conductors, closed at the top (the wires passing through bushed holes) and extending not less than seven feet from the floor. When crossing floor timbers, in cellars, or in rooms where they might be exposed to injury, wires must be attached by their insulating supports to the under side of a wooden strip not elss than one-half inch in thickness.

For general suggestions on protection, see note under No. 24 *e*. See also note under No. 18 *e*.

36. Transformers. (When permitted inside buildings under No. 13.)

(*See also Nos. 13 and 13 A.*)

Transformers must not be placed inside of buildings without special permission from the Inspection Department having jurisdiction.

a. Must be placed as near as possible to the point at which the primary wires enter the building.

This is to reduce the amount of high-voltage primary wire in the building to as small amount as possible.

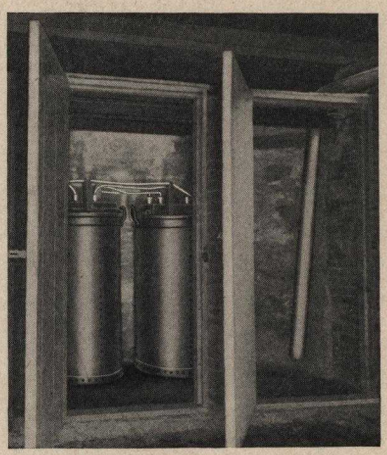


FIG. 52. TRANSFORMER VAULT IN BASEMENT OF BUILDING.

b. Must be placed in an enclosure constructed of fire resisting material; the enclosure to be used only for this purpose, and to be kept securely locked, and access to the same allowed only to responsible parties.

It is better to arrange the transformer room or enclosure so that it can be entered only from outdoors, since then, even if the door should happen to be open at the time of a fire in this room, it is probable that no especial harm would be done. Moreover, the fire could doubtless be better handled from the outside.

c. Must be thoroughly insulated from the ground, or permanently and effectually grounded, and the enclosure in which they are placed must be practically air-tight, except that it must be thoroughly ventilated to the outdoor air, if possible through a chimney or flue. There should be at least six inches air space on all sides of the transformer.

This rule will permit of either the insulating or grounding of transformer cases as seems most advisable under the conditions, but will require that with either arrangement the work be well done, and that unless good insulation be provided the cases be definitely grounded.

The object of an air-tight enclosure is to prevent smoke from escaping or fire from spreading, in case the transformer coils should become overheated from an overload or should be ignited by a break-down in the insulation between the primary and secondary coils. This is especially important with oil-cooled transformers, as explained in the note to Rule 11 a.

For requirements regarding grounding of transformer secondary circuits, see Rule 13 Ab. See also note at head of Rule 13.

Fig. 52 shows a brick transformer vault with a standard door in front of each transformer. Attention is called to the high threshold, intended to prevent the escape of oil if one of the transformers should boil over. The two ventilator pipes, visible at the right of the cut and leading outdoors, are made of galvanized iron and are 5 inches in diameter.

37. Series Lamps.

a. No multiple series or series multiple system of lighting will be approved.

(*See note under No. 20 c.*)

b. Must not, under any circumstances, be attached to gas fixtures.

(*See note under No. 20 d.*)

EXTRA-HIGH-POTENTIAL SYSTEMS.

OVER 3,500 VOLTS.

Any circuit atached to any machine or combination of machines which develops a difference of potential, between any two wires, of over 3,500 volts, shall be considered as an extra-high-potential circuit, and as coming under that class unless an approved transforming device is used, which cuts the difference of potential down to 3,500 volts or less.

38. Primary Wires.

a. Must not be brought into or over buildings except power stations and sub-stations.

39. Secondary Wires.

a. Must be installed under rules for high-potential systems when their immediate primary wires carry a current at a potential of over 3,500 volts, unless the primary wires are installed in accordance with the requirements as given in No. 12 A or are entirely underground, within city, town and village limits.

Class D.

FITTINGS, MATERIALS AND DETAILS OF CONSTRUCTION.

(Light Power and Heat. For Signaling Systems see Class E.)

All Systems and Voltages.

The following rules are but a partial outline of these requirements. Devices or materials which fulfill the conditions of these requirements and no more, will not necessarily be acceptable. All fittings and materials should be submitted for examination and test before being introduced for use.

40. General Rules.

a. Copper for insulated solid conductors of No. 4 B. S. gage and smaller must not vary in diameter more than .002 of an inch from the standard. On solid sizes larger than No. 4 B. & S. gage the diameter should not vary more than one per cent from the specified standard. The conductivity of solid conductors shall not be less than 97% of that of pure copper of the specified size.

In all stranded conductors the sum of the circular mils of the individual wires, shall not be less than the nominal circular mils of the strand by more than one and one-half per cent. The conductivity of the individual wires in a strand shall not be less than is given in the following table:—

40. General Rules—Continued.

Number	Per cent.
14 and larger	97.0
15	96.8
16	96.6
17	96.4
18	96.2
19	96.0
20	95.8
21	95.6
22	95.4
23	95.2
24	95.0
25	94.8
26	94.6
27	94.4
28	94.2
29	94.0
30	93.8

The Standard for diameters and milages shall be that adopted by the American Institute of Electrical Engineers.

b. Wires and cables of all kinds designed to meet the following specifications must have a distinctive marking the entire length of the coil so that they may be readily

40. General Rules—Continued.

identified in the field. They must also be plainly tagged or marked as follows:—

1. The maximum voltage at which the wire is designed to be used.
2. The words "National Electrical Code Standard."
3. Name of the manufacturing company and, if desired, trade name of the wire.
4. Month and year when manufactured.

Wires described under Nos. 42, 43 and 44 need not have the distinctive marking, but are to be tagged.

41. Rubber-Covered Wire.

a. Copper for conductors must be thoroughly tinned.

Insulation for Voltages, 0 to 600 inclusive.

b. Must be of rubber or other approved substances, homogeneous in character, adhering to the conductor and of a thickness not less than that given in the following table:—

B. & S. Gage.	Thickness.
18 to 16	1-32 inch
15 to 8	3-64 inch
7 to 2	1-16 inch
1 to 0000	5-64 inch
Circular Mils.	
250,000 to 500,000	3-32 inch
500,000 to 1,000,000	7-64 inch
Over 1,000,000	1-8 inch

Measurements of insulating wall are to be made at the thinnest portion of the dielectric.

c. The completed coverings must show an insulation resistance of at least 100 megohms per mile during thirty days' immersion in water at 70 degrees Farhrenheit (21 degrees Centigrade).

d. Each foot of the completed covering must show a dielectric strength sufficient to resist throughout five minutes the application of an electro-motive force proportionate to the thickness of insulation in accordance with the following table:—

THICKNESS in 64ths inches	BREAKDOWN TEST on 1 foot
1	3,000 Volts A. C.
2	6,000 " "
3	9,000 " "
4	11,000 " "
5	13,000 " "
6	15,000 " "
7	16,500 " "
8	18,000 " "
10	21,000 " "
12	23,500 " "
14	26,000 " "
16	28,000 " "

The source of alternating electro-motive force shall be a transformer of at least one kilowatt capacity. The application of the electro-motive force shall first be made at 4,000 volts for five minutes and then the voltage increased by steps of not over 3,000 volts, each held for five minutes, until the rupture of the insulation occurs. The tests for dielectric strength shall be made on a sample of wire which has been immersed in water for seventy-two hours. One foot of the wire under test is to be submerged in a conducting liquid held in a metal trough, one of the transformer terminals being connected to the copper of the wire and the other to the metal of the trough.

Insulation for Voltages, 601 to 3.500 inclusive.

e. The thickness of the insulating wall must not be less than that given in the following table:—

B. & S. S. Gage	Thickness.
14 to 1	3-32 inch
0 to 0000	3-32 inch covered by tape or braid.
Circular Mils.	
250,000 to 500,000	3-32 inch covered by tape or braid.
Over 500,000	1-8 inch covered by tape or braid.

f. The requirements as to insulation and break down resistance for wires for low-potential systems shall apply, with the exception that an insulation resistance of not less than 300 megohms per mile shall be required.

Insulation for Voltages over 3,500.

g. Wire for arc-light circuits exceeding 3,500 volts potential must have an insulating wall not less than three-sixteenths of an inch in thickness, and shall withstand a breakdown test of at least 23,500 volts and have an insulation of at least 500 megohms per mile.

The tests on this wire to be made under the same conditions as for low potential wires

41. Rubber Covered Wire—Continued.

Specifications for insulations for alternating currents exceeding 3,500 volts have been considered, but on account of the somewhat complex conditions in such work, it has so far been deemed inexpedient to specify general insulations for this use.

General.

h. The rubber compound or other approved substance used as insulation must be sufficiently elastic to permit all smaller than No. 7 B. & S. gage and larger than No. 11 B. & S. gage to be bent without injury to the insulation around a cylinder twice the diameter of the insulated wire measured over the outer covering. All wires No. 11 B. & S. gage and smaller to be bent without injury to the insulation around a cylinder equal to the diameter of the insulated wire measured over the outer covering.

i. All of the above insulations must be protected by a substantial braided covering, properly saturated with a preservative compound. This covering must be sufficiently strong to withstand all the abrasions likely to be met with in practice and must substantially conform to approved samples submitted by the manufacturer.

42. Slow-Burning Weatherproof Wire.

This wire is not as burnable as "weatherproof" nor as subject to softening under heat. It is not suitable for outside work.

a. This insulation must consist of two coatings, one to be fireproof in character and the other to be weatherproof. The fireproof coating must be on the outside and must comprise about 6-10 of the total thickness of the wall. The completed covering must be of a thickness not less than that given in the following table:—

B. & S. Gage.	Thickness.
14 to 8	3-64 inch
7 to 2	1-16 inch
1 to 0000	5-64 inch
Circular Mills.	
250,000 to 500,000	3-32 inch
500,000 to 1,000,000	7-64 inch
Over 1,000,000	1-8

Measurements of insulating wall are to be made at the thinnest portion.

b. The fireproof coating shall be of the same kind as that required for "slow-burning wire," and must be finished with a hard, smooth surface.

c. The weatherproof coating shall consist of a stout braid, applied and treated as required for "weatherproof wire."

43. Slow-burning Wire.

a. The insulation must consist of three braids of cotton or other thread, all the interstices of which must be filled with fireproofing compound or with material having equivalent resisting and insulating properties. The outer braid must be specially designed to withstand abrasion, and its surface must be finished smooth and hard. The completed covering must be of a thickness not less than that given in the table under No. 42 *a.*

The solid constituent of the fireproofing compound must not be susceptible to moisture, and must not burn, even when ground in an oxidizable oil, making a compound which, while proof against fire and moisture, at the same time has considerable elasticity, and which when dry will suffer no change at a temperature of 250 degrees Fahrenheit (121 degrees Centigrade), and which will not burn at even a higher temperature.

This is practically the old so-called "underwriters" insulation. It is especially useful in hot, dry places where ordinary insulations would perish, and where wires are bunched, as on the back of a large switch-board or in a wire tower, so that the accumulation of rubber insulation would result in an objectionably large mass of highly inflammable material.

44. Weatherproof Wire.

a. The insulating covering shall consist of at least three braids, all of which must be thoroughly saturated with a dense moisture-proof compound, applied in such a manner as to drive any atmospheric moisture from the cotton braiding, thereby securing a covering to a great degree waterproof and of high insulating power. This compound must retain its elasticity at 0 degrees Fahrenheit (minus 18 degrees Centigrade). and must not drip at 160 degrees Fahrenheit (71 degrees centigrade). The thichness of insulation must not be less than that given in the table under No. 42 *a*, and the outer surface must be thoroughly slicked down.

This wire is for use outdoors, where moisture is certain and where fireproof qualities are not necessary.

45. Flexible Cord.

(For installation rules, see No. 28.)

a. Must, except as required for portable heating apparatus (see section *g*), be made of stranded copper conductors, each strand to be not larger than No. 26 or smaller than No. 30 B. & S. gage, and each stranded conductor must be covered by an *approved* insulation and protected from mechanical injury by a tough, braided outer covering.

For Pendant Lamps.

In this class is to be included all flexible cord which, under usual conditions, hangs freely in air, and which is not likely to be moved sufficiently to come in contact with surrounding objects.

It should be noted that pendant lamps provided with long cords, so that they can be carried about or hung over nails, or on machinery, etc., are not included in this class, even though they are usually allowed to hang freely in air.

b. Each stranded conductor must have a carrying capacity equivalent to not less than a No. 18 B. & S. gage wire.

c. The covering of each stranded conductor must be made up as follows:—

1. A tight close wind of fine cotton.
2. The insulation proper. which shall be waterproof.
3. An outer covering of silk or cotton.

The wind of cotton tends to prevent a broken strand puncturing the insulation and causing a short circuit. It also keeps the rubber from corroding the copper.

d. The insulation must be solid, at least one thirty-second of an inch thick, and must show an insulation resistance of fifty megohms per mile throughout two weeks immersion in water at 70 degrees Fahrenheit (21 degrees Centigrade), and stand the tests prescribed for low-tension wires as far as they apply.

e. The outer protecting braiding should be so put on and sealed in place that when cut it will not fray out and where cotton is used, it should be impregnated with a flameproof paint, which will not have an injurious effect on the insulation.

The object of the flame-proof paint is obviously to make the cord as slow-burning as practicable, and any other method of treating the outer cotton cover which will accomplish this result will of course be acceptable. In no case, however, should the treatment be such that the rubber insulation is injured, or the flexibility or wearing qualities of the cord eventually lessened.

For Portables.

In this class is included all cord used on portable lamps, small portable motors, or any device which is liable to be carried about.

f. Flexible cord for portable use except in offices, dwellings or similar places. where cord is not liable to rough usage and where appearance is an essential feature, must meet all the requirements for flexible cord for 'pendant lamps," both as to construction and thickness of insulation, and in addition must have a tough, braided cover over the whole. There must also be an extra layer of rubber between the outer cover and flexible cord, and in moist places the outer cover must be saturated with a moisture proof compound, thoroughly slicked down as required for weatherprof wire." (See No. 44.) In offices, dwellings, or in similar places where cord is not liable to rough usage and where appearances is an essential feature, flexible cord for portable use must meet all the requirements for flexible cord for "pendant lamps," both as to construction and thickness of insulation. and in addition must have a tough, braided cover over the whole, or providing there is an extra layer of rubber between the flexible cord and the outer cover, the insulation proper on each stranded conductor of cord may be 1-64 of an inch in thickness instead of 1-32 of an inch as required for pendant cords.

Flexible cord for portable use may, instead of the outer coverings described above, have an approved metal flexible armor.

For Portable Heating Apparatus.

Applies to all smoothing and sad irons and to any other device requiring over 250 watts.

g. Must be made up as follows:—

1. Conductors must be braided copper, each strand not to be larger than No. 30 or smaller than No. 36 B. & S. gage.

When conductors have a greater carrying capacity than No. 12 B. & S. gage they may be braided or stranded with each strand as large as No. 28 B. & S. gage. If stranded there must be a tight, close wind of cotton between the conductor and the insulation.

45. Flexible Cord—Continued.

2. An insulating covering of rubber or other *approved* material not less than one sixty-fourth inch in thickness.
3. A braided covering of not less than one thirty-second inch thick, composed of best quality long fibre asbestos, containing not over 5 per cent of vegetable fibre.
4. The several conductors comprising the cord to be enclosed by an outer reinforcing cover not less than one sixty-fourth inch thick. especially designed to resist abrasion, and so treated as to prevent the cover from fraying.

46. Fixture Wire.

(For installation rules, see No. 24 v to y.)

a. May be made of solid or stranded conductors, with no strands smaller than No. 30 B. & S. gage, and must have a carrying capacity not less than that of a No. 18 B. & S. gage wire.

b. Solid conductors must be thoroughly tinned. If a stranded conductor is used, it must be covered by a tight close wind of fine cotton.

c. Must have a solid rubber insulation of a thickness not less than one thirty-second of an inch for Nos. 18 to 16 B. & S. gage, except that in arms of fixtures not exceeding twenty-four inches in length and used to supply not more than one sixteen-candle-power lamp or its equivalet, which are so constructed as to render impracticable the use of a wire with one thirty-second of an inch thickness of rubber insulation, a thickness of one sixty-fourth of an inch will be permitted.

d. Must be protected with a covering at least one sixty-fourth of an inch in thickness, sufficiently tenacious to withstand the abrasion of being pulled into the fixture, and sufficiently elastic to permit the wire to be bent around a cylinder with twice the diameter of the wire without injury to the braid.

e. Must successfully withstand the tests specified in No. 41 c. and 41 d.

In wiring certain designs of show-case fixtures, ceiling bulls-eyes and similar appliances in which the wiring is exposed to temperatures in excess of 120 degrees Fahrenheit (49 degrees Centigrade), from the heat of the lamps, slow-burning wire may be used (see No. 43.) All such forms of fixtures must be submitted for examination, test and approval before being introduced for use.

47. Conduit Wire.

(For installation rules, see No. 24 n to p.)

a. Single wire for lined conduits must comply with the requirements of No. 41. For unlined conduits it must comply with the same requirements (except that tape may be substituted for braid), and in addition there must be a second outer fibrous covering, at least one thirty-second of an inch in thickness and sufficiently tenacious to withstand the abrasion of being hauled through the metal conduit.

b. For twin or duplex wires in lined conduit, each conductor must comply with the requirements of No. 41 (except that tape may be substituted for braid on the separate conductors), and must have a substantial braid covering the whole. For unlined conduit each conductor must comply with requirements of No. 41 (except that tape may be substituted for braid), and in addition must have a braid covering the whole at least one thirty-second of an inch in thickness and sufficiently tenacious to withstand the abrasion of being hauled through the metal conduit.

c. For concentric wire the inner conductor must comply with the requirements of No. 41 (except that tape may be substituted for braid), and there must be outside of the outer conductor the same insulation as on the inner, the whole to be covered with a substantial braid, which for unlined conduits must be at least one thirty-second of an inch in thickness and sufficiently tenacious to withstand the abrasion of being hauled through the metal conduit.

The braid or tape required around each conductor in duplex, twin and concentric cables is to hold the rubber insulation in place and prevent jamming and flattening. All the braids specified in this rule must be properly saturated with a preservative compound.

50. Mouldings.

(For wiring rules, see No. 24 k to m.)

a. Must have, both outside and inside, at least two coats of waterproof material, or be impregnated with a moisture repellent.

This is necessary in order to fill up the pores of the wood and prevent the possibility of its becoming saturated with water.

b. Must be made in two pieces, a backing and a capping, and must afford suitable protection from abrasion. Must be so constructed as to thoroughly encase the wire, be provided with a tongue not less than ½ inch in thickness between the conductors and have exterior wall which under grooves shall not be less than ⅜ inch in thickness, and on the sides not less than ¼ inch in thickness.

It is recommended that only hard-wood moulding be used.

CLASS E.

MISCELLANEOUS.

64. Signaling Systems.

Governing wiring for telephone, telegraph, district messenger and call-bell circuits, fire and burglar alarms, and all similar systems which are hazardous only because of their liability to become crossed with electric light, heat or power circuits.

a. Outside wires should be run in underground ducts or strung on poles, and kept off the roofs of buildings, except by special permission of the Inspection Department having juridiction, and must not be placed on the same cross-arm with electric light or power wires. They should not occupy the same duct manhole or handhole of conduit systems with electric light or power wires.

Single manholes, or handholes, may be separated into sections by means of partitions of brick or tile so as to be considered as conforming with the above rule.

The liability of accidental crossing of overhead signaling circuits with electric light and power circuits may be guarded against to a considerable extent by endeavoring to keep the two classes of circuits on different sides of the same street.

When the entire circuit from Central Station to building is run in underground conduits, Sections b to m inclusive do not apply.

b. When outside wires are run on same pole with electric light or power wires, the distance between the two inside pins of each cross-arm must not be less than twenty-six inches.

Signaling wires being smaller and more liable to break and fall should generally be placed on the lower cross-arms.

c. Where wires are attached to the outside walls of buildings they must have *approved* rubber insulating covering (see No. 41), and on frame buildings or frame portions of other buildings shall be supported on glass or porcelain insulators, or knobs.

d. The wires from last outside support to the cut-outs or protectors must be of copper, and must have an *approved* rubber insulation (see No. 41); must be provided with drip loops immediately outside the building and at entrance, must be kept not less than two and one-half inches apart, except when brought in through approved metal-covered cables.

e. Wires must enter the building through approved non-combustible, non-absorptive, insulating bushings sloping upwards from the outside.

Installations where the Current Carrying Parts of the Apparatus Installed are Capable of Carrying Indefinitely a current of Ten Amperes.

f. An all-metallic circuit shall be provided except in telegraph systems.

g. At the entrance of wires to buildings, *approved* single pole cutouts, designed for 251-600 volts potential and containing fuses rated at not over ten amperes capacity, shall be provided for each wire. These cut-outs must not be placed in the immediate vicinity of easily ignitible stuff, or where exposed to inflammable gases, or dust or to flyings of combustible material.

h. The wires inside building shall be of copper not less than No. 16 B. & S. gage, and must have insulation and be supported, the same as would be required for an installation of electric light or power wiring, 0-600 volts potential.

i. The instruments shall be mounted on bases constructed of non-combustible, non-absorptive, insulating material. Holes for the supporting screws must be so located or countersunk, that there will be at least one-half inch-space, measured over the surface, between the head of the metal screw and the nearest live metal part.

64. Signaling Systems—Continued.

Installations where the current Carrying Parts of the Apparatus Installed are Not Capable of Carrying Indefinitely a Current of Ten Amperes.

j. Must be provided with an *approved* protective device located as near as possible to the entrance of wires to building. The protector must not be placed in the immediate vicinity of easily ignitible stuff, or where exposed to inflamable gases or dust or flyings of combustible materials.

k. Wires from entrance to building to protector must be supported on porcelain insulators, so that they will come in contact with nothing except their designed supports.

l. The ground wire of the protective device shall be run in accordance with the following requirements:—

1. Shall be of copper and not smaller than No. 18 B. & S. gage.
2. Must have an *approved* insulating covering as described in No. 41, for voltage from 0 to 600, except that the preservative compound specified in No. 41, Section *h* may be omitted.
3. Must run in as straight a line as possible to a good permanent ground. This may be obtained by connecting to a water or gas pipe connected to the street mains or to a ground rod or pipe driven in permanently damp earth. When connections are made to pipes, preference shall be given to water pipes. If attachment is made to gas pipe, the connection in all cases must be made between the meter and the street mains. In every case the connection shall be made as near as possible to the earth.

When the ground wire is attached to water or gas pipes, these pipes shall be thoroughly cleaned and tinned with rosin flux solder, if such a method is practicable; the ground wire shall then be wrapped tightly around the pipe and thoroughly soldered to it.

When the above method is impracticable, then if there are fittings where a brass plug can be inserted, the ground wire shall be thoroughly soldered to it; if there are no such fittings, then the pipe shall be thoroughly cleaned and an approved ground clamp fastened to an exposed portion of the pipe and the ground wire well soldered to the ground clamp.

When the ground wire is attached to a ground rod driven into the earth, the ground wire shall be soldered to the rod in a similar manner.

Steam or hot-water pipes must not be used for a protector ground.

m. The protector to be approved must comply with the following requirements:—

For Instrument Circuits of Telegraph Systems.

1. An *approved* single pole cut-out, in each wire, designed for 2,000 volts potential, and containing fuses rated at not over one ampere capacity. When main line cutouts are installed as called for in section *g*, the instrument cut-outs may be placed between the switchboard and the instrument as near the switchboard as possible.

64. Signaling Systems—Continued.

For All Other Systems.

1. Must be mounted on non-combustible, non-absorptive, insulating bases, so designed that when the protector is in place, all parts which may be alive will be thoroughly insulated from the wall to which the protector is attached.

2. Must have the following parts:—

A lightning arrester which will operate with a difference of potential between wires of not over 500 volts, and so arranged that the chance of accidental grounding is reduced to a minimum.

A fuse designed to open the circuit in case the wires become crossed with light or power circuits. The fuse must be able to open the circuit without arcing or serious flashing when crossed with ordinary commercial light or power circuit.

A heat coil, if the sensitiveness of the instrument demands it, which will operate before a sneak current can damage the instrument the protector is guarding.

Heat coils are necessary in all circuits normally closed through magnet windings, which cannot indefinitely carry a current of at least five amperes.

The heat coil is designed to warm up and melt out with a current large enough to endanger the instruments if continued for a long time, but so small that it would not blow the fuses ordinarily found necessary for such instruments. The smaller currents are often called "sneak" currents.

3. The fuses must be so placed as to protect the arrester and heat coils, and the protector terminals must be plainly marked "line," "instrument," "ground."

An easily read abbreviation of the above words will be allowed.

The Following Rules Apply to All Systems Whether the Wires from the Central Office to the Building are Overhead or Under-ground.

n. Wires beyond the protector or wires inside buildings where no protector is used, must be neatly arranged and securely fastened in place in some convenient, workmanlike manner. They must not come nearer than six inches to an electric light or power wire in the building unless encased in approved tubing so secured as to prevent its slipping out of place.

The wires should ordinarily be insulated, but the kind of insulation is not specified, as the protector is relied upon to stop all dangerous currents. Porcelain tubing or *approved* flexible tubing may be used for encasing wires where required as above.

b. Wires where bunched together in a vertical run within any building must have a fire-resisting covering sufficient to prevent the wires from carrying fire from floor to floor unless they are run either in non-combustible tubing or in a fireproof shaft, which shaft shall be provided with fire stops at each floor.

Signaling wires and electric light or power wires may be run in the same shaft, provided that one of these classes of wires is run in non-combustible tubing, or provided that when run otherwise these two classes of wires shall be separated from each other by at least two inches

In no case shall signaling wires be run in the same tube with electric or power wires.

Ordinary rubber insulation is inflammable, and when a number of wires are contained in a shaft extending through a building they afford a ready means of carrying fire from floor to floor, unless they are covered with a fire-resisting material, or unless the shaft is provided with fire stops at each floor.

65. Electric Gas Lighting.

a. Electric gas lighting must not be used on the same fixture with the electric light.

The above rule does not apply to *frictional* systems of gas lighting.

65A. Moving Picture Machines.

a. Arc lamps used as a part of moving picture machines must be constructed similar to arc lamps of theatres, and wiring for same must not be of less capacity than No. 6 B. & S. gage. (See No. 31A *d.* [1].)

b. Rheostats must conform to rheostat requirements for theatre arcs (See No. 31 A *d.* [1].)

c. Top reel must be encased in a steel box with hole at the bottom only large enough for film to pass through, and cover so arranged that this hole can be instantly closed. No solder to be used in the construction of this box.

d. A steel box must be used, for receiving the film after being shown, with a hole in the top only large enough for the film to pass through freely, with a cover so arranged that this hole can be instantly closed. An opening may be placed at the side of the box to take the film out with a door hung at the top, so arranged that it cannot be entirely opened and provided with spring catch to lock it closed. No solder to be used in the construction of this box.

e. The handle or crank used in operating the machine must be secured to the spindle or shaft so that there will be no liability of its coming off and allowing the film to stop in front of the lamp.

f. A shutter must be placed in front of the condenser, arranged so as to be readily closed

g. Extra Films must be kept in metal box with tight fitting cover.

h. Machines must be operated by hand (motor driven will not be permitted.)

i. Picture machines must be placed in an enclosure or house made of suitable fireproof material, be thoroughly ventilated and large enough for operator to walk freely on either side of or back of machine. All openings into this booth must be arranged so as to be entirely closed by doors or shutters constructed of the same or equally good fire-resisting material as the booth itself. Doors or covers must be arranged so as to be held normally closed by spring hinges or equivalent devices.

66. Insulation Resistance.

The wiring in any building must test free from grounds; *i. e.*, the complete installation must have an insulation between conductors and between all conductors and the ground (not including attachments, sockets, receptacles, etc.) not less than that given in the following table:

Up to	5 amperes	4,000,000 ohms.
Up to	10 amperes	2,000,000 ohms.
Up to	25 amperes	800,000 ohms.
Up to	50 amperes	400,000 ohms.
Up to	100 amperes	200,000 ohms.
Up to	200 amperes	100,000 ohms.
Up to	400 amperes	50,000 ohms.
Up to	800 amperes	25,000 ohms.
Up to	1,600 amperes	12,500 ohms.

The test must be made with all cut-outs and safety devices in place. If the lamp-sockets, receptacles, electroliers, etc., are also connected, only one-half of the resistance specified in the table will be required.

67. Soldering Fluid.

a. The following formula for soldering fluid is suggested:—

Saturated solution of zinc chloride	5 parts.
Alcohol	4 parts.
Glycerine	1 part

APPENDIX.

GROUND DETECTORS.

With the exception of intentionally grounded neutral wires, it is always important to keep the wires of any electric light or power system absolutely free from contacts with anything which could connect them to the earth, such as walls or floors of masonry, iron beams, etc., and, above all, iron pipes of any kind. This is accomplished in ordinary mill work, first by the porcelain knobs or cleats on which the wires are supported, and next, by the insulation on the wires themselves. Wires do sometimes get out of place, however, and come in contact with damp walls, sprinkler pipes, etc., and then in time the insulation on the wire wears through, helped by the jar of the building, and the copper itself comes in contact with the wall, pipe, etc., thus putting the wire into electrical connection with the earth. Nothing will usually happen, however, until a wire of opposite polarity also becomes "grounded,"

Ground Detectors—Continued.

for until then there is no complete circuit made. When this does occur, the current follows through the earth or pipes from one "ground" to the other, forming arcs at these points, and perhaps elsewhere, and these arcs are very liable to cause fire.

The purpose of the ground detector is to give a warning when the first break in insulation occurs, thereby giving time to repair it before the second one, with its possible accompanying fire, can follow.

The instant a detector shows a ground, steps should be taken to find and remedy it. By throwing off one circuit after another, the one on which the ground exists will soon be found, as when it is cut off the detector lamps will again burn with equal brilliancy. Inspection along this circuit will then generally soon disclose the trouble. Where the circuits are not well subdivided by switches, fuses may be removed to accomplish the same result.

Direct-Current Circuits.

Fig. 53 shows a very good and simple detector for any two-wire low-voltage system. The lamps for the detector should be of the same candle power and voltage, —the voltage being about the same as that of the regular lamps in the plant,—and two lamps should be selected which, when connected in series, burn with equal brillancy. Although somewhat greater sensitiveness can be obtained with low candle-power lamps, such as 8 c. p., for example, it is believed in general to be preferable to use lamps of same candle-power as those throughout the plant, as then a burned-out or broken detector lamp can be immediately replaced by a good lamp from the regular stock, thus avoiding the necessity of keeping on hand a few spare special lamps.

The detector lamps, being two in series across the proper voltage for one lamp, burn only dimly. If, however, a ground occurs on any circuit, as at *a*, the current from the positive bus-bar through lamp No. 1 divides on reaching *b*, instead of all going through lamp No. 2, as it did when there was no ground. Part now goes down the ground wire and through the ground to *a*, as indicated by the broken line, and thence through the wires to the negative bus-bar. This reduces the resistance from *b* to the negative bus-bar, and therefore more current flows through lamp No. 1 than before, while less current flows through lamp No. 2. Lamp No. 1 consequently brightens and lamp No. 2 dims. If the ground had occurred at *c* instead of *a*, lamp No. 2 would have brightened and lamp No. 1 dimmed.

Attention is called to the following points, which are frequently neglected in this form of detector:—

1. The lamp receptacles should be keyless and there should be no switches of any kind in any of the connecting wires, so that the detector will always be in operation.

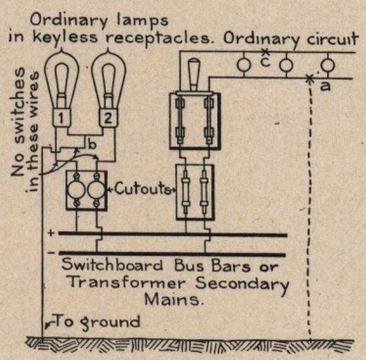


Fig. 53. Two-Lamp Ground Detector.

In order to be of the greatest value, the indications must be given instantly when a ground occurs, and not have to wait until the engineer or electrician remembers to close a switch.

2. The wires should be protected by small fuses where they connect to the bus-bars. If these fuses are omitted, a short-circuit across these wires would either burn up the wires or blow the main generator fuses.

3. The lamps should be placed very close together, within 1 or 2 inches of each other if possible. The farther

Ground Detectors—Continued.

apart they are, the harder it is to detect any slight difference in brilliancy between them.

4. The ground wire should be carefully soldered to a pipe which is thoroughly connected to the ground, or some other equally good ground connection should be provided.

In some laboratory tests of a two-lamp detector made with two ordinary 110 volt, 16 c. p. lamps, the following sensitiveness was found.

Difference in Brightness of Lamps.	Insulation Resistance Ohms.
Just noticeable in rather dark place	2700
Easily detected	1700
One lamp red, other bright	500

This shows that the detector, while not able to indicate extremely small leaks, will show any leak that is likely to be dangerous from a fire standpoint.

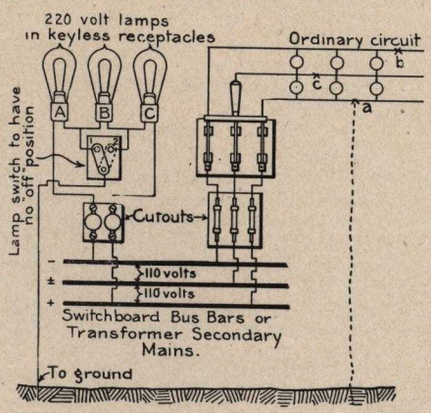


Fig. 54. Lamp Ground Detector for Three Wire System.

Fig. 54 shows a lamp ground detector for a three-wire Edison system. In principle it is exactly the same as the two-lamp detector of Fig. 53. Its indications are as follows:—

Switch on point No. 1.....	Ground at	*a*,—	A bright, B & C dim.
	"	*b*,—	B & C " A "
	"	*c*,—	A " B & C "
Switch on point No. 2.....	Ground at	*a*,—	A & B bright, C dim.
	"	*b*,—	C " A & B "
	"	*c*,—	C " A & B "

With the lamp at point No. 1. grounds at *a* and *c* give the same indication, but by throwing the switch to point No. 2, it will be at once evident whether the ground is on the positive or the negative side. It is to remove the uncertainty which would otherwise exist that this switch is needed. It should have no "off position, so that the detector can never be left out of circuit.

The man in charge of a plant can readily familiarize himself with the indications of the detector by purposely putting a ground on the different wires and noting the indications.

If the neutral is permanently grounded, as permitted in Rule 13 A, a ground detector is, of course, of no use.

The following table shows the sensitiveness obtained in some laboratory tests, using ordinary 220 volt, 16 c. p. lamps.

Difference in Brightness in Lamps	Insulation Resistance, Ohms. Positive	Negative	Neutral
Just noticeable in rather dark place	18800	8900	3700
Easily detected	9000	6500	2600
One or two lamps, dull red, others bright	3800	3300	500
One or two lamps faint red, others bright	2400	1400	0
One or two lamps just out others bright	1200	700	0

The same degree of sensitiveness on both sides can be obtained by means of the lamp switch, but for grounds on neutral, there is never more than half the full voltage

Ground Detectors—Continued.

available to operate the lamps, so that the indications are necessarily less sensitive.

An ordinary voltmeter can be used as an intermittent ground detector on direct-current circuits of any voltage, the method being as shown in Fig. 55. The voltmeter

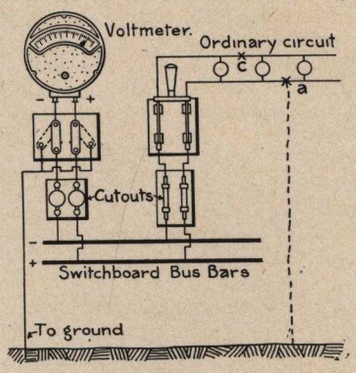


FIG. 55. VOLTMETER GROUND DETECTOR.

ordinarily used to indicate the pressure on the system, can, of course, be used for this purpose, the voltmeter switch shown in the cut being arranged to give the different desired connections.

If, for example, the system shown in Fig. 55 was of about 100 volts, the voltmeter would register 100 when the levers of the switch were on the inside contact points as shown. If, now, the right-hand lever was moved to the outside contact points as shown dotted, and there was a ground on the system as at *a*, current would pass from the positive bus-bar through the circuit to *a*, thence through the ground to the ground wire, and through the voltmeter to the negative bus-bar, causing the voltmeter to read something below 100, unless the ground at *a* was practically a perfect connection, in which case the voltmeter reading would be 100. If the positive side was entirely free from grounds, the voltmeter reading would be 0.

Assume that under these conditions the voltmeter read 50, and that the resistance of the voltmeter itself was 20,000 ohms, it will be evident that if, with no external resistances, as when connected directly to the bus-bars, the voltmeter read 100, while now it reads 50, the total resistance under the new conditions must be 40,000 ohms, of which 40,000—20,000=20,000 ohms must be the resistance of the ground at *a*.

If the voltmeter had read only 20 the total resistance would have

$$\frac{100}{20}\times 20{,}000 = 100{,}000$$

been——×20,000=100,000 and the resistance of the ground 100,000—20,000=80,000 ohms.

A table may, therefore, be computed in this way showing the resistance of the ground for any given reading of the voltmeter. It is a good plan in any low-voltage system to connect the voltmeter in this way, besides having a lamp ground detector, as the voltmeter gives a more exact idea of just what the insulation is, while the lamp detector gives an instantaneous indication of a ground and is not dependent on the attendant remembering to throw it in, as is the case with the voltmeter.

A special ground-detecting voltmeter designed for continuous operation and arranged with a pointer moving on each side of a zero point, so that a ground on either side of the system will be automatically shown, can be obtained. Such a detector makes the best instrument for all direct-current work where the voltage is too high for the use of any form of lamp detector, as, for instance, on series arc light circuits. This special instrument is better than an ordinary voltmeter arranged as in Fig. 55, as it can be kept in circuit all the time, thus being entirely automatic in its action.

Where none of the above-mentioned methods are available, fair results can be obtained by frequent tests with a powerful magneto while the current is off from the system.

Ground Detectors—Continued.

Alternating-Current Circuits.

For all ordinary low-voltage single-phase systems, the lamp detectors above described can be used with good results.

For ordinary low-voltage three-phase circuits, a lamp detector connected as in Fig. 56, may be used. The indication is the same as that with the lamp detectors described above. Thus, when a ground comes on one wire,

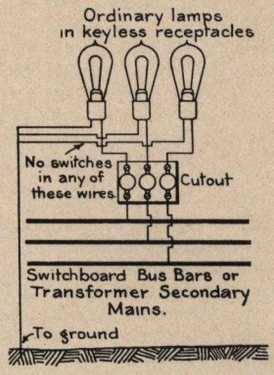


FIG. 56. THREE PHASE GROUND DETECTOR.

the lamp attached to that wire dims and the other two brighten.

For ordinary two-phase (or quarter-phase) systems, where the phases are entirely insulated from each other, the two-lamp detector can be used, one detector on each phase. There are, however, in this class of wiring several complicated systems, to all of which the lamp detector principle is applicable, although the exact method of connections, differs in each case, so that no general rule can be given.

With alternating-current systems where the voltage is too high for the methods suggested above, excellent results can be obtained where direct current is available by testing the line with a direct-current voltmeter, as in Fig. 55. This can only be done, of course, while the high-voltage current is cut off. If there is no direct current at hand, the line may be frequently tested out with a powerful testing magneto when the current is off the system. With extra high voltages, there is usually either no ground or else a fairly good one, so that either of these two methods can be used to advantage.

There are also a few instruments on the market especially designed for this work, such as the electrostatic detector, in which the difference of static charge on adjacent segments moves a pivoted vane, to which is attached an indicating needle moving over a dial. There is also the "transformer and lamp" detector, in which a small transformer is used with an incandescent lamp in the secondary circuit. One of the primary wires is connected with the ground, and by means of switches suitably arranged, the other primary is connected to any wire of the system, a ground being indicated by the burning of the lamp. The indications of this instrument are misleading, except to those thoroughly acquainted with its operation under all conditions.

General Wiring Formulae.

$$V=\frac{D\times W\times R\times B}{E\times A}, \text{ or } V=\frac{L\times E\times B}{100}$$

$$A=\frac{D\times W\times R\times B}{E\times V}, \text{ or } A=\frac{D\times W\times R}{L\times E^2}$$

$$C=\frac{W\times T}{E}$$

$$L=\frac{D\times W\times R\times 100}{E^2\times A}$$

$$P=\frac{D^2\times W\times R\times S}{L\times E^2\times 10{,}000}, \text{ or } P=\frac{D\times S\times A}{1{,}000{,}000}$$

V=Volts drop in line.

Ground Detectors—Continued.

D=Distance, in feet, between the two points, along the Wires.
W=Total power *delivered*, in watts.
E=Voltage at *receiving* end of line.
A=Area of cross-section of wire, in circular mils.
C=Current in each wire, in amperes.
L=Loss in line, in per cent. of W.
P=Total pounds of copper in line.
R=A constant, for value of which see table below.
S= " " " " " "
T= " " " " " "
B= " " " " " "

For direct-current systems, R=21.6, B=1.00, T=1.00, and W=C×E, so that the first two of the above formulæ reduce to

$$V=\frac{D\times C\times 21.6}{A}, \text{ and } A=\frac{D\times C\times 21.6}{V}$$

In a balanced three-wire, two-phase, alternating-current system, the current in the middle wire is 1.41 times that in each outside wire, the current in the outside wires being computed from the formula as if the system was a four-wire one.

When the power factor cannot be accurately determined, it may be assumed to be as follows for any alternating-current system operating under average conditions: lighting, with no motors, 95%; lighting and motors. 85%; motors only, 80%.

The values of B are for wires 18 inches apart, centre to centre, and are sufficiently accurate for all practical purposes, provided that the reactance of the line is not excessive or the line loss unusually high. They represent the true values at 10% line loss; are close enough for all losses less than 10%; and are often close enough for losses considerably above 10%—at least for frequencies up to 40 cycles. Where the conductors of a circuit are less than 18 inches apart, the value of B is less than that given in the table, and if they are close together, as with multiple conductor cable, B becomes equal to unity and can be omitted from the formulæ.

The following examples are given to show how the different formulæ are to be applied:—

1. What size wire is needed to transmit current 200 feet to a centre of distribution for 60 incandescent lamps

Ground Detectors—Continued.

on a 110 volt direct-current system, with a drop of 3%, which is an actual drop of 3.3 volts?

The table below shows that a 16 c. p. lamp at 110 volts takes .52 ampere, so 60 lamps would take 31.2 amperes.

Hence D=200, C=31.2, and V= 3.3, from which, using the simplified formula for direct-current, we have,

$$A=\frac{200\times 31.2\times 21.6}{3.3}=40840.$$

From the table below we see that the nearest B. & S. gage size above this is No. 4, which is the proper size to use.

2. What is the current in each wire of a three-phase circuit feeding two motors developing 20 H. P. each, the voltage at the motors being 550?

40 H. P.=40×746 watts=29840 watts. Assuming a power-factor of 85% (see note above), we find from the table that the value of T for this power-factor on a three-phase, three-wire system is .68. Assume also an efficiency of 84%. Then from the formula we have

$$C=\frac{29840\times .68}{550\times .84}=44 \text{ amperes}$$

3. In a two-phase, 60 cycle transmission line, with four No. 2 B. & S. gage wires 18 inches apart, supplying lighting transformers at a point 1⅝ miles from the generating station, what must be the voltage at the generator switchboard to give a voltage of 2080 at the transformers when the load on the transformers is 188 K. W.?

1⅝ miles=8580 feet, and 188 K. W.=188000 watts. Hence D=8580, W=188000, E=2080; and from the table R=12,000, A=66600, and B=1.18, assuming a power factor of 95%.

Inserting these values in the formulæ for L and V, we have

$$L=\frac{8580\times 188000\times 12\times 100}{(2080)^2\times 66600}=6.72 \text{ and}$$

$$V=\frac{6.72\times 2080\times 1.18}{100}=165 \text{ volts.}$$

Therefore the voltage at the generator must be 2080+165=2245.

SYSTEM	VALUES OF S.	VALUES OF R. PER CENT POWER FACTOR 100	95	90	85	80	VALUES OF T. PER CENT POWER FACTOR 100	95	90	85	80
Single-phase	6.04	21.60	24.00	26.60	30.00	33.80	1.00	1.05	1.11	1.17	1.25
Two-phase (four-wire)	12.08	10.80	12.00	13.30	15 00	16 90	.50	.53	.55	.59	.62
Three-phase (three-wire)	9.06	10.80	12.00	13.30	15 00	16.90	.58	61	.64	.68	.72

No. of Wire, B. & S Gage.	Area Wire, Circular Mils.	Weight of Bare Wire per 1000 feet, Pounds.	Resistance of Wire per 1000 feet at 25° C., Ohms.	VALUES OF B (for wires 18 inches apart.) 25 CYCLES. PER CENT. POWER FACTOR 95	90	85	80	40 CYCLES PER CENT. POWER FACTOR. 95	90	85	80	60 CYCLES. PER CENT. POWER FACTOR. 95	90	85	80	125 CYCLES. PER CENT. POWER FACTOR. 95	90	85	80	No. of Wire, B. & S. Gage.
0000	212000	641	.0499	1.23	1.29	1.33	1.34	1.52	1.53	1.61	1.67	1.62	1.84	1.99	2.09	2.35	2.86	3.24	3.49	0000
000	168000	509	.0628	1.18	1.22	1.24	1.24	1.40	1.41	1.48	1.51	1.49	1.66	1.77	1.95	2.08	2.48	2.77	2.94	000
00	133000	403	.0794	1.14	1.16	1.16	1.16	1.25	1.32	1.35	1.37	1.34	1.52	1.60	1.66	1.86	2.18	2.40	2.57	00
0	106000	320	.0997	1.10	1.11	1.10	1.09	1.19	1.24	1.26	1.26	1.31	1.40	1.46	1.49	1.71	1.96	2.13	2.25	0
1	83500	253	.126	1 07	1.07	1.05	1.03	1.14	1.17	1.18	1.17	1 24	1.30	1.34	1.36	1 56	1.75	1.88	1.97	1
2	66600	202	.159	1.05	1.04	1.02	1.00	1.11	1.12	1.12	1.10	1.18	1.23	1.25	1.26	1.45	1.60	1.70	1.77	2
3	52400	159	.202	1.03	1.02	1.00	1.00	1.07	1.08	1.07	1.05	1.14	1.17	1.18	1.17	1.35	1.46	1.53	1.57	3
4	41600	126	.254	1 02	1.00	1.00	1.00	1.05	1.06	1.03	1 00	1.11	1.12	1.11	1.10	1.27	1.35	1.40	1.43	4
5	33100	100	.319	1.00	1.00	1.00	1.00	1.03	1.01	1.00	1.00	1.08	1.08	1.06	1.04	1.21	1.27	1.30	1.31	5
6	26200	79 5	.403	1.00	1.00	1.00	1.00	1.02	1.00	1.00	1.00	1.05	1.04	1.02	1.00	1.16	1.20	1.21	1.21	6
7	20700	62.8	.510	1.00	1.00	1.00	1.00	1.01	1.00	1.00	1.00	1.03	1.02	1.00	1.00	1.12	1.14	1.14	1.13	7
8	16600	50.4	.635	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.02	1.00	1.00	1.00	1.09	1.10	1.09	1.07	8
9	13000	39.4	.813	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1 00	1.00	1.00	1.00	1.00	1.06	1.06	1.04	1.02	9
10	10400	31.5	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.04	1.03	1.00	1.00	10

Report of the New Rules Adopted at the Sixteenth Annual Meeting of the Electrical Committee, Held March 25-26, 1908.

Mercury Vapor Lamps.

New rule to follow present Rule 29, with heading "Enclosed Mercury Vapor Lamps."

a. Must have cut-out for each lamp or series of lamps except when contained in single frame and lighted by a single operation, in which case not more than five lamps should be dependent upon single cut-out.

b. Must only be furnished with such resistances or regulators as are enclosed in non-combustible cases, such resistances to be treated as sources of heat. In locations where these resistances or regulators are subject to flying of lint or combustible material, all openings through cases must be protected by fine wire gauze.

Add new Rule (29A) with heading "High Potential Vacuum Tube Systems."

1. The tube should be so installed as to be free from mechanical injury or liability to contact with inflammable material.

2. High potential coils and regulating apparatus must be installed in approved steel cabinet not less than 1/10 inch in thickness; same to be well ventilated in such a manner as to prevent the escape of any flame or sparks, in case of burnout in the various coils. All apparatus in this box must be mounted on slate base and the enclosing case positively grounded. Supplying conductors leading into this high potential case to be installed in accordance with the standard requirements governing low potential systems, where such wires do not carry a potential of over 300 volts.

Rheostats.

Amend the fine print note under Rule 8, Section d, by striking out the first three words and also by omitting the words "they should either be enclosed in cabinets or else" (in the 9th and 10th lines.)

Amend Rule 60, by adding a new section to read: Starting duty resistances shall either be so constructed that if the resistance conductor be fused the arc, or any attendant flame or molten droppings, shall be confined within the rheostat; or they shall be constructed with such capacity that when the rated full-load current is passed through the entire resistance for a period of five minutes there shall be no resultant flaming, or molten droppings.

Continuous duty resistances shall either be so constructed that if the resistive conductor be fused the arc or any attendant flame or molten droppings shall be confined within the rheostat or they shall be constructed with such capacity that if subjected to a current flow throughout the entire rheostat, 25 per cent. in excess of that at which they are rated, for a period of two hours, there shall be no resultant flaming or molten droppings.

New Rules Under Low Potential Systems.

The following sections do not apply to apparatus or fittings, the operation of which depends either wholly or in part upon special transformers embodied in the devices, but all such apparatus or fittings must be submitted for special examination and approval before being used.

Transformers.

24B. Oil transformers:—

Must not be placed inside of any building except central stations and sub-stations, unless by special permission of the inspection department having jurisdiction.

Air-cooled transformers.

a. Must not be placed inside of any building, excepting central stations and sub-stations, unless the highest voltage of either primary or secondary does not exceed 550 volts.

b. Must be so mounted that the case shall be at a distance of one foot from combustible material or separated therefrom by non-combustible, non-absorptive, insulating material, such as slate or marble.

c. Where transformers are placed at a distance of less than one foot from combustible material, this will necessitate the use of a slab or panel of non-combustible, non-absorptive, insulating material, such as slate or marble, somewhat larger than the transformer.

Electric Cranes.

Note: All wiring, apparatus, etc., not specifically covered by special rules herein given, must conform to the Standard Rules and Requirements of the National Electrical Code, except that the switch required by Rule 8c for each motor may be omitted.

(a) Wiring.

1. All wires except bare collector wires, those between resistances and contact plates of rheostats and those subjected to severe external heat, must be approved, rubber-covered and not smaller in size than No. 12 B. & S. Wires between resistances and contact plates of rheostats must conform to No. 4-c, unless the wires are exposed to moisture, in which case the insulation must also be rubber. Wires subjected to severe external heat must have approved slow-burning insulation.

2. All wires excepting collector wires and those run in metal conduit or approved flexible cable must be supported by knobs or cleats which separate them at least one inch from the surface wired over, but in dry places where space is limited the distance between wires as required by Rule 24-h cannot be obtained, each wire must be separately encased in approved flexible tubing securely fastened in place.

Collector wires must be supported by approved insulators so mounted that even with the extreme movement permitted the wires will be separated at all times at least 1½ inches from the surface wired over. Collector wires must be held at the ends by approved strain insulators.

3. Main collector wires carried along the runways must be rigidly and securely attached to their insulating supports at least every 20 feet, and separated at least six inches when run in a horizontal plane; if not run in a horizontal plane, they must be separated at least 8 inches. If spans longer than 20 feet are necessary the distance between wires must be increased proportionately but in no case shall the span exceed 40 feet.

4 Where bridge collector wires are over 80 feet long insulating supports on which the wires may loosely lie must be provided at least every 50 feet.

Bridge collector wires must be kept at least 2½ inches apart, but a greater spacing should be used whenever it may be obtained.

5. Collector wires must not be smaller in size than specified in the following table for the various spans.

Distance between rigid supports. Feet.	Size wire required. B. & S.
0 to 30	6
31 to 60	4
Over 60	2

(b) Collectors.

Must be so designed that sparking between them and collector wires will be reduced to a minimum.

(c) Switches and Cut-Outs..

1. The main collector wires must be protected by a cut-out and the circuit controlled by a switch, cut-out and switch to be so located as to be easy of access from the floor.

2. Cranes operated from cabs must have a cut-out and switch connected into the leads from the main collector wires and so located in the cab as to be readily accessible to the operator.

3. Where there is more than one motor on a single crane, each motor lead must be protected by a cut-out located in the cab if there is one.

(d) Controllers.

Must be installed according to No. 4, except that if the crane is located out doors the insulation on wires between resistances and contact plates of rheotats must be rubber where the wires are exposed to moisture and insulation is necessary and also where they are grouped. If the crane operates over readily combustible material, the resistance must be placed in an enclosure made of non-combustible material, thoroughly ventilated and so constructed that it

Report of New Rules—Continued.

will not permit any flame or molten metal escaping in the event of burning out the resistances. If the resistances are located in the cab, this result may be obtained by constructing cab of non-combustible material and providing sides which enclose cab from its floor to a height at least 6 inches above the top of the resistances.

(e) Grounding of Iron Work.

The motor frames, the entire frame of the crane and the tracks must be permanently and effectively grounded.

Rules 24-A-c, 25 d, 25 f and 49 A-b.

24 A-c Add fine print note to read as follows:

It is recommended that cables, outlet boxes and fittings having conductive coatings be used in order to secure better electrical contact at all points throughout the cable system.

25d. Add fine print note to read:

It is recommended that outlet boxes and fittings having conductive coatings be used in order to secure better electrical contact at all points throughout the conduit system.

25f. Amend fine print note by insertion of the following as third sentence:

If conduit, couplings, outlet boxes or fittings having protective coating of non-conducting material, such as enamel, are used, such coating must be thoroughly removed from threads of both couplings and conduit and from surfaces of boxes and fittings where the conduit is secured in order to obtain the requisite good connection.

49 A-b. Amend by adding fine print note to read as follows:

It is recommended that the protective coating be of conductive material such as tin or zinc.

49 A-e. Amend to read:

Must be arranged to secure in position the conduit or flexible tubing protecting the wire.

Must in case of combination gas and electric outlets be so arranged that connection with gas pipe at outlet may be made by means of a set screw or some other approved device.

49 A. Amend by changing heading to read:

Outlet, junction and flush switch boxes. Fine print subheading: For boxes for panel-boards, cut-outs and switches other than flush switches, see Rule 54.

(See proposed revision of Rule 54 to be presented by sub-committee of switch and cut-out committee.)

Amend section a, to read:

a. Must be of pressed steel having wall thickness not less than .081 inch (No. 12 B. & S. gage), or of cast metal having wall thickness not less than ⅛ inch. Junction boxes of larger sizes must comply with requirements of Rule 54, but must in all cases be of metal.

Variable Speed Motors.

All varying (or adjustable) speed alternating current motors except those used for railway service must be marked with the maximum current which they can safely carry for 30 minutes, starting cold.

Fine print note:

Varying speed motors are motors in which the speed varies automatically with the load, decreasing when the load increases, and vice versa. It does not mean motors in which the speed is varied by the use of different windings or groupings of windings, or motors in which the speed is varied by external means, and in which, after adjusting to a certain speed, the speed remains practically constant.

The current used in determining the size of the motor leads or branch circuits must be the percentage of the 30-minute current rating of the motor as given for the several classifications of service in the following table:

Classification of Services.	Percentage of current rating of motor.
Operating valves, raising or lowering rolls, tool heads, etc.	200
Hoists, rolls, ore and coal-handling machines.	180
Freight elevators, shop cranes	160
Passenger elevators	140
Rolling tables, pumps	120

Outline Lighting.

(31 B) Wiring (other than Signs on Exterior of Buildings).

(a) Must be connected only to low-potential systems.

Report of New Rules—Continued.

(b) Open or conduit work may be used, but molding will not be permitted.

(c) For open work, wires must have an approved rubber insulating covering. Must be rigidly supported on non-combustible, non-absorptive insulators, which separate the wires at least one inch from the surface wired over, and must be kept apart at least two and one-half inches for voltages up to 300, and four inches for higher voltages.

Rigid supporting requires under ordinary conditions where wiring over flat surfaces, supports at least every four and one-half feet. If the wires are liable to be disturbed, the distances between supports should be shortened. sealed and painted with moisture repellant, and kept at least one-half inch from surface wired over.

(e) Wires for use in rigid conduit must be such as are approved for unlined conduit work. While flexible metal conduit or armored cable is used, the conductors must be protected from moisture by lead sheath.

(f) Must be protected by its own cut-out, and controlled by its own switch. Cut-outs, time switches, flashes and similar appliances, must be of approved design, and must if located inside the building, be installed as required by the Code for such devices. If outside the building they must be enclosed in a steel or cast-iron box.

If a steel box is used, the minimum thickness of the steel must be 0.128 of an inch (No. 8 B. & S. gage.)

Boxes must be so constructed that when switch operates the blade shall clear the door by at least one inch, and they must be moisture proof.

(h) Circuits must be so arranged that not more than 1320 watts will be finally dependent upon a single cut-out; nor shall more than 66 sockets or receptacles be connected to single circuit.

(i) Sockets and receptables must be of the keyless porcelain type, and wires must be soldered to lugs on same.

Street Railways.

The following changes have been recommended:

Rule 32, Section f, Par. 1.—Change to read as follows:

Each outlet to be provided with an approved receptacle, or an approved cluster, no lamp consuming more than 128 watts to be used.

Rule 32, Section g, Par. 2.—New sentence.

Truss plank heaters to be mounted on not less than one-quarter inch fire-resisting insulating material, the legs or supports for the heaters providing an air space of not less than one-half inch between the back of the heater and the insulating material.

Rule 33, Section e, Par. 3:

Change "No. 00 B. & S. gage" in third and seventh line of the paragraph to "No. 0 B. & S. gage."

Changes in the Rules of the National Electrical Code Governing the Construction of Panel Boards.

Change Rule 51c (bases of knife switches) to read as follows:

(c) Bases.—Must be mounted on non-combustible, non-absorptive, insulating bases. Other materials than slate, marble or porcelain must be submitted for special examination before being used. Bases with an area of over, etc. (as at present given in rule).

Rule 53 A.—Insert the following fine print explanatory note ahead of "a. Design."

The following specifications are intended to apply to all panel and distributing boards used for the control of light and power circuits, but not to such switchboards in central stations, sub-stations or isolated plants as directly control energy derived from generators or transforming devices.

Add new section as follows:

(a) Design.—The specifications for construction of switches and cut-outs (see Rules 51 and 52) must be followed as far as they apply.

In the relative arrangement of fuses and switches, the fuses may be placed between the bus-bars and the switches, or between the switches and the circuits, except in the case of service switches, when Rule 21a must be complied with. When the branch switches are between the fuses and bus-bars, the connections must be so arranged that the blades will be dead when the switches are open.

When there are exposed live metal parts on the back of board, a space of at least one inch must be provided between such live metals and the cabinet in which board is mounted.

Report of New Rules—Continued.

(b) Spacings.—The following minimum distance between bare live metal parts (bus-bars, etc.) must be maintained:

Between parts of opposite polarity, except at switches and link fuses.		Between parts of same polarity.
When mounted on the same surface.	When held free in air.	At link. fuses.
0-125 volts, ¾ inch.	½ inch.	½ inch.
126-250 volts, 1¼ inch.	¾ inch.	¾ inch.
251-600 volts, 2 inch.	1¾ inch.	

Fine print note:

At switches or enclosed fuses, parts of the same polarity may be placed as close together as convenience in handling will allow.

Fine print note:

It should be noted that the above distances are the minimum allowable, and it is urged that greater distances be adopted wherever the conditions will permit.

Fine print note:

The spacings given in the first column apply to the branch conductors where enclosed fuses are used. Where link fuses or knife switches are used, the spacings must be at least as great as those required by Nos. 51 and 52.

Fine print note:

The spacings given in the second column apply to the distance between the raised main bars and between these bars and the branch bars over which they pass.

Fine print note:

The spacings given in the third column are intended to prevent the melting of a link fuse by the blowing of an adjacent fuse of the same polarity.

Add new fine print note:

Panel boards of special design in which the insulation and separation between bus-bars and between other current carrying parts is secured by means of barriers or insulating materials instead of by the spacings given above, must be submitted for special examination and approval before being used.

Add new Section:

(c) Marking.—Must be marked where the marking can be plainly seen when installed, with the name or trademark of the manufacturer and the maximum capacity in amperes and the voltage for which the board is designed.

The suggested changes in rules governing cabinets were referred back to a sub-committee for further consideration.

Rule 13 A was referred back to sub-committee for further report.

Reports from Laboratories Accepted.

The Laboratories suggest the adoption of the following committee opinion:

The use of soft rubber bushings about lead and supply wires in frames of motors or dynamos is permitted, except when installed where oils, grease, oily vapors or other substances known to have rapid deleterious effect on rubber, are present in such quantities and in such proximity with motor or dynamo as may cause bushings to be liable to rapid destruction. In such cases the use of hard wood properly filled, or preferably porcelain or micanite bushings may be called for.

The Laboratories recommend the adoption of the following additional fine print note under Rule 60a:

In drum controllers and apparatus of like nature used in connection with rheostats, where the controlling mechanism is entirely enclosed in a substantial tight metal case or compartment, hard wood or other suitable material may be used for bases for mounting current carrying parts, or for other parts which can not be readily made of non-combustible material, provided such combustible material is present only in such amount and so disposed that, even if it be totally destroyed by fire or excessive heat, the effect shall be confined to the interior of the case.

The Laboratories recommend that Rule 62, Section b, paragraph 2, be amended to read as follows:

When heated to normal full load operating temperature, the insulation of transformers, the normal primary voltage of which does not exceed 5,000 volts, shall withstand continuously for one minute a difference of potential of 10,000 volts (alternating) between primary and secondary coils and between the primary coils and the core. For higher primary voltages the test shall be at double the normal voltage. Transformers shall also withstand a no-load "run" at double voltage for thirty minutes.

Report of New Rules—Continued.

Suggested Changes in Rules Adopted.

Rule 2, Section e.—Amend to read as follows:

Must, where not in conduit, be kept so rigidly in place that they cannot come in contact.

Rule 12g was amended by making the second and third sentences to read as follows: "The conduit to be equipped with approved service-head. The inner end must extend tc the service cut-out, etc.

Rule 22, Section a, was amended to read as follows: "Must be placed on all service wires, either overhead or underground in the nearest readily accessible place, to the point where the wires," etc.

Rule 24, Section a, together with fine print note, was striken out of the Code.

Rule 24, Section o.—Make the paragraph beginning a "turn of 90 degrees, etc.," the first recommended method of supporting cable in conduits.

Rule 24, Section p.—Second fine print note was amended to read as follows: "The same conduit must not contain more than 4 two-wire or 3 three-wire circuits of the same system, except by special perimssion of the Inspection Department having jurisdiction, and must never contain circuits of different systems.

Rule 24, Section x.—Change word "of" after "fastenings" to "or."

Rule 24 A, Section d was amended by striking out the word "concealed" in third line and inserting the words "exposed to moisture."

Rule 24 A, Section a.—Omit word "underground" in first line in fine print note.

Rule 24 A—Add new section as follows:

All bends must be so made that the armor of the cable will not be injured. The radius of the curve of the inner edge of any bend not to be less than 1½ inches.

Rule 26, Section c.—Change to read:

Must be free from "contacts" between conductors and fixture, "short circuits" and ground connections, and must be tested for such conditions before being connected to the supply conductors.

Rule 26.—Add new section to read as follows:

The so-called flat canopy sometimes used on electric and combination fixtures will not be approved except in connection with outlet boxes.

Rule 26.—New section was added to Rule 26 to read as follows: "Must when installed on the outside of frame buildings be of water-tight construction."

Rule 26.—Add new section:

Must not when wired on the outside, be used in show windows or in the immediate vicinity of especially inflammable stuff.

Rule 28, Section e.—Insert after "show windows" the words "show cases or similar places."

Rule 28, Section g was amended by changing the word "device" in the third line to "method" and by striking out entirely the fine print note.

Rule 31 A, Section c., 4e—Borders change to read Cables must be made up of approved stranded, rubber-covered wires, and must be continuous, etc.

Rule 31 A.—Amend Section b, paragraphs 1, 3a, 4c, also Section e. paragraph 1, and Section e, paragraph 1, so as to allow of the use of approved armored cable in place of approved conduit.

Rule 31 A, Section c, Paragraph 2.—Amend to read as follows:

Rule 31 A, Section b, 4e. Borders.—Change to read: "Cables must be made up of approved standard rubber covered wires, and must be continuous, etc."

All pendent lights must be equipped with approved reinforced cord, armored cable or steel armored flexible cord.

Rule 34, Section a.—Amend to read as follows:

Must not be permitted, under any pretence, in the same circuit with trolley wires with a ground return, except in electric railway cars, electric car houses, power houses, passenger and freight stations connected with the operation of electric railways.

Rule 49, Section h.—Amend by omitting the words in the third line:

When removed from the pipe entire.

Rule 51, Section j.—Amend fine print note to read as follows:

Triple pole switches designed with 125 volt spacings between adjacent blades, should be marked 125 volts, and

Report of New Rules—Continued.

may be used on D. C. 3-wire systems having 125 volts between adjacent wires and 250 volts between the two outside wires.

Rule 51, Section n.—Amend by omitting from the rule the words:

The contacts being arranged so that a thoroughly good bearing at every point is obtained.

Rule 51, Section n.—Amend by omitting the fine print note.

Rule 51, Section o.—Amend by omitting the last sentence.

Rule 51, Section s.—Amend second paragraph by adding the words:

For switches rated higher than ten amperes, this test shall be at 25 per cent overload instead of 50 per cent.

Rule 51, Section s.—Add the following fine print note after the first paragraph:

Snap switches of the spring break pattern, normally complying with the above requirements, but with movement of the contact carrier under control of the operator at any point in the operation of the device, must be considered in a class with switches of the regular knife blade pattern and conform to the specifications of Rule 51k.

Rule 51, Section t.—Amend second paragraph by omitting the words:

On the back of the face plate or.

Rule 53, Section k was amended by striking out the words "not more than" in the third line of the third paragraph.

Rule 60, Section a.—Add the following fine print note:

Wood or other suitable material may be used for parts

Report of New Rules—Continued.

of the casings or covers of drum controllers, providing these parts are properly lined or treated with fire resisting materials, and so arranged that should the combustible parts within the casing be ignited, the fire would be confined within the casing or cover.

Miscellaneous Suggestions Adopted.

1. All self-fastening knobs, cleats or supports must be secured with suitable screws.

2. All floor receptacles or fittings must be of an approved water-tight type.

16. Ground connections for conduit system must be made with copper wire and clamps, wire to be not less than No. 6 B. & S. gage.

18. Wires in moulding must be in continuous lengths from outlet to outlet, or from fitting to fitting, no joints or taps to be made in moulding. Where branch taps are necessary in moulding approved fittings for this purpose must be used.

22. The adoption of a rule forbidding the dead-ending of a 4½ foot run on a cleat type socket or rosette.

(The above suggestion was referred to the Secretary and Chairman with instructions to incorporate a rule in the code which would accomplish the object of the suggestion, but be more definite in its terms.)

27. Rule 3.—New clause requiring switchboards to have main switch, main cut-out, ammeters, volt-meters and ground dectector.

28. Rule 13A.—Make grounding of transformer secondary compulsory when primary exceeds 550 volts.

48. In all places in the Code where "slate or marble" is called for, add the alternative of "soapstone."

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